KNOWLEDGE
AN ILLUSTRATED
MAGAZINE OF SCIENCE
PLAINLY WORDED—EXACTLY DESCRIBED

LONDON: FRIDAY, MAY 16, 1884.

CONTENTS OF No. 133.

	PAGE
Sent to the Bottom. I. By Richard A. Proctor	341
The Chemistry of Cookery. XXXIV. By W. M. Williams	342
Life in Mars. By R. A. Proctor	343
The Morality of Happiness: Care of Others. By Thomas Foster	345
Cremation. By R. A. Proctor	346
Moved from Afar. I. The Emotions	348
Standard Time. By J. K. Rees	349
Reviews	350
Optical Recreations. (*Illus.*) By F.R.A.S.	351
The Amateur Electrician: Batteries. IX. (*Illus.*)	352
Editorial Gossip	354
Correspondence: Strange Coincidence — Mystery of Gravity — Earthquakes—Scientific Morality	356
Our Mathematical Column	359
Our Chess Column	361
Our Whist Column	363

SENT TO THE BOTTOM.

By RICHARD A. PROCTOR.

AFTER every great accident by fire or by water or by storm, too much is said and too little is done, about measures of prevention. Unpractical men suggest impossible devices; precautions are urged which could not possibly be adopted; and then after a little time matters return to their old course until the next great accident of the same kind sets men talking again but too often doing little or nothing.

But in the case of collisions at sea and especially of such collisions as have recently occurred, there is so wide a recognition of the utter inadequacy of the measures actually adopted to avoid accident, that one really marvels how those whose lives and property depend on proper arrangements being employed can for a single year or even a single month allow matters to proceed without change. Indeed if it were not that so much were at stake, so many lives and such valuable property involved, one might be disposed to smile at the almost childish way in which sailors ("Sing, hey, the simple seamen that they are") propose to guard steam-vessels from the danger of collision in foggy or hazy weather, or at night. Everything it should seem depends on a ready and rapid recognition of the real position and course of a ship that is sighted by the look-out; yet by the arrangement actually adopted the signal lights tell little or nothing even when they have been sighted, and matters are so ingeniously planned that they are sighted only at distances far within those over which, were proper measures adopted, they might well be seen.

Let it be noticed in the first place that the use of coloured lights at sea is a delusion and a snare. They do well enough on a railway (except in foggy weather); for there they are only required to throw their rays over a defined and moderate distance. But at sea the further a signal light is seen, no matter what its purpose is, the better; and the interposition of coloured glass limits in marked and measurable degree the range over which a light casts its beams. If there were no other way but by the use of colour that the meaning of a signal light could be indicated there might be some excuse for the preposterous course by which the power of these safety-lights (as they should be) is diminished. But there are many ways in which white lights can be made to serve all the purposes of coloured lights in the way of signalling, and as they can be seen much further, they signal much more effectively.

Again the use of but two sidelights, one on the port the other on the starboard beam, would in these days be an absurdity if it were not an atrocity. What can a single light *say?* Let it be as strong as it may it can only tell the people of another ship that the port side or the starboard side of another ship is turned towards them at the moment, when perhaps everything depends on their knowing *in what degree* that side is turned their way. The other ship may be steering on a course at right angles to the direction in which she is seen, or at a sharp angle to that direction so as to be rapidly drawing nearer, or at an obtuse angle so as to be rapidly drawing away. And note that the uncertainty which the people on one ship have as to the position and bearing of the other is reciprocated by equal uncertainty on the part of the people on the latter ship as to the position and bearing of the former. Consider what is likely to come of such uncertainty, at night, when it is remembered that even in broad daylight ships that have been in sight of each other for some time, and have been able severally to watch each manœuvre, have been known to come into collision. If with everything to favour them, two ships do sometimes run into each other (through some such confusion of purpose as sometimes causes two passing pedestrians to dodge from side to side, while each is as anxious as the other to pass clear) how much greater must the risk always be at night or in hazy weather, no matter what precautions may be adopted? Yet with an almost childish simplicity those who have arranged the Rule of the Road at sea provide for no other precaution than that a red light shall be hung on the port side and a green light on the starboard side of a steamship at night.

Now it may be laid down as a tolerably sound proposition that even the smallest steamship is worth proper signal lights, even if so many as a dozen, instead of two or three, should be necessary to ensure safety. For passengers or for freight, a slightly higher charge might, if necessary, well be made to secure at least such protection as proper side-lights might give. If a steamship herself is so utterly worthless that her owners cannot afford either for her or for any freight live stock or passengers she may have to carry the extra expense which half-a-dozen more lights at night would give, she ought not to be free to run happy-go-lucky over the seas (as all steamships do now,—and sailing ships are worse). She may cause destruction to ships and cargoes of much greater value. If sunk she may obstruct navigation for weeks. She is in fine not worth sending to sea if she is not worth such proper lighting as will make her safe herself and no longer a source of danger to other ships.

We may go a little further in this direction. Every steamship is worth proper lighting at sea, and not one is now properly lighted; but the large and swift ocean steamers are at once better worth effective lighting, and more urgently need it, whether we consider their swift course as regards themselves or as it affects the safety of others. If it is not too much to say that the smallest steamship afloat in the open sea should carry at least eight good white lights, it certainly may be as truly said that the *Germanic* and the *Oregon*, the *City of Rome* and the *Gallia*, should carry as many strong electric signal lights at least in foggy or hazy weather and when nearing the sea regions where steamships most do congregate. The same remark may of course be extended to large steam war vessels.

It may very well be that a long time will elapse before the owners of our great ocean steamers will recognise the economy of suitable electric lighting. A certain amount of mechanical power devoted to work a dynamo machine may seem to them wasted, when they want every cubic inch of steam devoted to the propulsion of the mighty steamship across the ocean. It seems so unlikely that the big ship will be the one to suffer seriously in any collision, so certain that aught which may come in her way will simply be sent to the bottom, that a wealthy and selfish owner may be tempted to disregard the rights of others and to overlook how largely the loss brought about by one such catastrophe as the destruction of the *City of Brussels* must overvalue the expense of efficient electric signal lamps in constant use for twenty or thirty years.

But apart from this it should be noticed that the time when electric lights would be most useful—that is in thick and hazy weather—is a time when they could be maintained without any loss of power at all. When the engines are at rest or slowed down, there is an abundance of energy available for working a dynamo-electric machine by which if necessary a score of powerful electric lights could be maintained. In a very short time, when the *City of Brussels* had been brought to rest on account of the fog which actually brought about her destruction, electric lights might have been set aglow, which would have shown her position to the *Kirby Hall* in ample time to have prevented that disaster. The *Kirby Hall* herself might equally have born electric signal lights at the time if as is stated she was going dead slow.

What electric lights would be worth in time of haze and fog at sea those can judge who have ever witnessed experiments for comparing the haze-penetrating power of the electric light, gas, the best oil lights, and coloured lights. It is certainly no exaggeration to say that in an ordinary sea fog, a good electric light would show at least ten times as far as the best coloured side lights now in use. If half-a-dozen electric lights or so were shown on each side, the distance at which the neighbourhood of a ship would be recognised would be increased in yet greater degree, for the glare would be discernible before the individual lights would be seen.

(To be continued.)

THE CHEMISTRY OF COOKERY.

XXXIV.

By W. Mattieu Williams.

RESPECTING the rationale of the change that takes place in reheating stale bread, thereby renewing it and making it appear moist by actually driving away some of its moisture, the results of my investigations are as follows:—

I find that as bread becomes stale, its porosity *appears* to increase, and that when renewed by reheating, it returns to its original *apparently* smaller degree of porosity. That this change can be only apparent is evident from the facts that the total quantity of solid material in the loaf remains the same, and its total dimensions are retained more or less completely by the rigidity of the crust. I say "more or less," because this depends upon the thickness and hardness of the crust, and also upon the completeness of its surrounding. Lightly-baked loaves shrink a little in dimensions in becoming stale, and partly regain the loss on reheating, but this difference only exaggerates the apparent paradox of varying porosity, as the diminished bulk of a given quantity of material displays increased porosity, and the increase of total dimensions accompanies the diminished porosity.

A reconciliation of this paradox may be obtained by careful examination of the structure of the crumb. This will show that the larger or decidedly visible pores are cells having walls of somewhat silky appearance. This silky lustre and structure is, I have no doubt, due to a varnish of dextrine, the gummy nature of which I have already described. Now look a little more closely at this inner surface of the big blow-holes with the aid of a hand-lens of moderate power. It is not a continuous varnish of gum, but a net-work or agglomeration of gummy fibres and particles, barely touching each other.

My theory of the change that takes place as the bread becomes stale is that these fibres and particles gradually approach each other either by shrinkage or adhesive attraction, and thus consolidate and harden the walls of each of the millions of visible pores, *i.e.*, the solid material of which the loaf is made up. In doing so they naturally increase the dimensions of these visible pores, while the invisible interstices or spaces between the minute fibres of the cell walls are diminished by the approximation or adhesion of these fibres to each other.

This adhesion is probably aided by an oozing out or efflorescence of the vapour held by the fibres, and its condensation on their surfaces. This point, be it understood, is merely hypothetical, as the efflorescence is not visible.

When the stale bread is again heated, a general expansion occurs by the conversion of liquid water into aqueous vapour, every grain of water thus converted expanding to 1,700 times its former bulk. As this happens throughout, *i.e.*, upon the surface of every one of the countless fibres or particles, there must be a general elbowing in the crowd, breaking up the recent adhesion between these fibres and drawing them all apart in the directions of least resistance, *i.e.*, towards the open spaces of the larger and visible pores, producing that *apparent* diminution of porosity that I have observed as the visible characteristic of the change.

This explanation of the change may be further demonstrated by cutting a loaf through the middle from top to bottom, and exposing the cut surfaces. In this case the bread becomes unequally stale, more so near the cut surface than within. The unequal pull due to the greater adhesive approximation of the fibres and small particles causes a rupture of the exposed surface of the crumb, which becomes cracked or fissured without any perceptible alteration of the size of the visible pores. If the two broken faces be now accurately placed together, the halves thus closely joined firmly tied together and placed for an hour in the oven, it will be seen on separating them that the chasms are considerably closed, though not quite healed. Careful examination of the structure of the inside, by breaking out a portion of the crumb, will reveal that loosening of the structure which I have described.

I should add that, in quoting the figures given by Boussingault in my last, I inadvertently omitted to reduce them from the French to the English thermometric scale. 130° to 150° Centigrade is equal to 266° to 302° Fahrenheit, which is considerably below the temperature required for starting the original baking.

"Popped corn" is a peculiar example of starch cookery. Here a certain degree of porosity is given to an originally close-compacted structure of starch by the simple operation of explosive violence due to the sudden conversion into vapour of the water naturally associated with the starch. The operation is too rapid for the production of much dextrin.

As most of my readers doubtless know, peas, beans, lentils and other seeds of leguminous plants are more

nutritious, theoretically, than the seeds of grasses, such as wheat, barley, oats, maize, &c. I was glad to see at the Health Exhibition a fine series of the South Kensington cases displaying in the simplest and most demonstrative manner the proximate analyses of the chief materials of animal and vegetable food. I refer to them now because they do not receive the attention they deserve. On the opening day there was, out of all the crowd, only one other besides myself bestowing any attention upon them. I soon learned in conversation with him that he is a reader of KNOWLEDGE. These cases show 1 lb. of wheat, oats, potatoes, peas, &c., &c., on trays; by the side of these are bottles, containing the quantity of water in the 1 lb., and other trays, with the other constituents of the same quantity, the starch, gluten, casein, the mineral matter, &c., thus displaying at a glance the nutritive value of each so far as chemical analysis can display it. Those Irishmen and others who think I have been too hard upon the potato, will do well to take its nutritive measure thus, and compare it with that of other vegetable foods.

They will see that all the leguminous seeds, the groundnuts, &c., have their nitrogenous constituents displayed under the name of "casein." The use of this term is rather confusing. In many modern books it does not appear at all in connection with the vegetable kingdom, but is replaced by "legumin." Liebig regarded this nitrogenous constituent of the leguminous seeds, almonds, &c., as identical with the casein of milk, and it was a pupil and friend of Liebig's—the late Prince Consort—who devised and originally supervised this graphic method of displaying the chemistry of food.*

I will not here discuss the vexed question of whether the analyses of Liebig, identifying legumin with casein, or rather those of Dumas and Cahours, who state that the vegetable casein is not of the same composition as animal casein, are correct.

The following figures display my justification for thus lightly treating the discussion:—

	Casein.	Legumin.	Legumin.	Legumin.
Carbon ...	53·7	50·50	55·05	56·24
Hydrogen ...	7·2	6·78	7·59	7·97
Nitrogen ...	16·6	18·17	15·89	15·83
Oxygen } Sulphur }	22·5	24·55	21·47	19·96

The first column shows the results of Dumas for animal casein; the second those of Dumas and Cahours for legumin; the third those of Jones for the same; and the fourth those of Rochleder; all as quoted by Lehmann. Here it will be seen that the differences upon which Dumas and Cahours base their supposed refutation of the identity of the animal with the vegetable principle are much smaller than the differences between the results of different analyses of the latter. These differences I suspect are all due to the difficulty of isolating the substances in question, especially of the vegetable substance, which is so intimately mixed with the starch, &c., in its natural condition that complete separation is of questionable possibility.

This will be understood by the following description of the method of separation as given by Miller ("Elements of Chemistry," Vol. 3). "Legumin is usually extracted from peas or from almonds, by digesting the pulp of the crushed seeds in warm water for two or three hours. The undissolved portion is strained off by means of linen, and the turbid liquid allowed to deposit the starch which it holds in suspension; it is then filtered and mixed with dilute acetic acid. A white flocculent precipitate is thus formed, which must be collected on a filter and washed."

This is but a mechanical process, and its liability to variation in result will be learned by anybody who will repeat it, or who has separated the gluten of flour by similar treatment.

Practically regarded in relation to our present subject, casein and legumin may be considered as the same. Their nutritive values are equal and exceptionally high, supposing they can be digested and assimilated. One is the most difficult of digestion of all the nutritive constituents of vegetable food, and the other enjoys the same distinction among those of animal food. Both primarily exist in a soluble form, both are rendered solid and insoluble in water by the action of acids; *both are precipitated as a curd by rennet*, and both are rendered soluble after precipitation or are retained in their original soluble form by the action of alkalis. They nearly resemble *in flavour*, and John Chinaman makes actual cheese from peas and beans.

These facts, coupled with what I have already said concerning cheese and its cookery, will doubtless lead my readers to expect something concerning peas-pudding and potash in my next.

* Shortly after the close of the great Exhibition of 1851, when the South Kensington Museum was only in embryo, I had occasion to call at the "boilers," and there found the Prince hard at work giving instructions for the arrangement and labelling of these analysed food products and the similarly displayed materials of industry, such as whalebone, ivory, &c. I then, by inquiry, learned how much time and labour he was devoting, not only to the general business of the collection, but also to its minor details.

LIFE IN MARS.

By R. A. PROCTOR.

(*Continued from p.* 304.)

BUT we are naturally led to inquire whether the phenomena which our meteorologists have to deal with—clouds, fog, and mist, wind-storms and rain-storms—can be recognised, either directly or in their effects, when Mars is studied with the telescope. The answer is full of interest. We have been able to learn much respecting the meteorology of this distant world. In the first place, we see that at times the features of his globe—those well-recognised markings which indicate the figure of oceans and continents—are hidden from view as if by clouds. A whitish light replaces the well-marked red colour of the continents or the equally well-marked green-blue tint of the oceans. But more. We can at times actually watch the gradual clearing up of the Martial skies, for we can see the whitish region of light gradually growing smaller and smaller, the features it had concealed coming gradually into view. On one occasion Mr. Lockyer was observing Mars with an excellent telescope, when he became aware that a change of this sort was in progress. A certain well-known sea was partially concealed from view by a great cloud-mass spreading over many thousand square miles of the Martial surface. But as the hours passed, the clouds seemed to be melting away, whether by the sun's heat or because they had fallen in rain was, of course, not determinable. When Mr. Lockyer ceased observing for the evening—at about half-past eleven—a large proportion of the sea before concealed had come into view. But on the same night, the eagle-eyed Dawes, the prince of modern telescopists, as he has been called, was also studying the Planet of War. Waiting until the outlines of the oceans and continents had become clearly discernible, he made ("in the wee sma' hours ayont the twal") an excellent drawing of Mars. When this was compared with the drawing made at an earlier hour by Mr. Lockyer, it was seen that the clouds which had concealed a portion of the planet had, at the later hour, passed completely away, insomuch that the whole of the shore-

line, which was at first concealed, had been restored to view. And it is worthy of notice, that, referring these events to Martial time, the cloudy weather in this part of Mars appears to have occurred in the forenoon, the midday hour (as often happens on earth) bringing clear weather, which would seem to have lasted until the Martial afternoon was far advanced.

But we can also learn something of the general progress of the weather during a Martial day. It would seem that, as a rule, the Martial mornings and evenings are misty. This, at least, seems the most satisfactory explanation of the whitish light which is usually seen all round the planet's disc; for the parts of the planet which lie near the edge of the disc are those where the sun is low—that is, where it is either morning or evening out yonder on Mars. The presence, therefore, of this whitish light would seem to indicate misty mornings and misty evenings in Mars.

It seems clear too that—as with ourselves—winter is more cloudy than summer; for it is always noticed that near the Martial solstices the markings on that half of the planet where winter is in progress are very indistinctly seen, a whitish light sometimes replacing the red and green markings altogether in these regions. On the contrary, the regions where summer is in progress are generally very well seen.

The reader will infer from what has been said on these points, that the study of Mars cannot be carried on very rapidly by our astronomers; for, in the first place, Mars only returns to our midnight skies at intervals of more than two years, and he remains but for a short time favourably placed for observation. Then one half of his surface only can be seen at a time, and nearly one-half even of that hemisphere is commonly concealed by clouds, which also extend all round the disc, so that perhaps, but about one-eighth of the planet's surface can be favourably studied. When we add to these considerations the circumstance that not one night out of ten in our climate—or, perhaps, in any—is well suited for the use of powerful telescopes, while even favourable nights cannot always be devoted to the study of Mars (other celestial objects often requiring special attention), it will be understood that the progress of discovery has not been so rapid as, at a first view, might be expected. When we are told that more than two centuries have elapsed since the telescopic study of Mars began, it seems as though ample time had been given for research; but the time which has been actually available for that purpose has been far more limited than that estimate would imply.

And now, returning to the consideration of the probable condition of Mars, with respect to those circumstances which we regard as associated with the requirements of living creatures, let us briefly inquire how far we can determine aught as to the geological structure of the planet. Here the spectroscope cannot help us. The telescope, and such reasoning as may fairly be applied to the relations already dealt with, must here be our main resource. We see, then, that the land regions of the planet present a ruddy tinge. Sir John Herschel has suggested, and I am not here concerned to deny, that this is probably due to the ochreish nature of the soil. The planet, in fact, is to be regarded as perhaps passing through a geological era resembling that through which our own earth was passing when the Old Red Sandstone constituted the main proportion of her continents. But it certainly must be admitted, as a remarkable circumstance, that we can trace no signs of extensive forests in Mars, nor any such appearances as we should imagine that our prairies must present to telescopists in Venus or Mercury. One is almost invited to adopt the bizarre notion of that French astronomer who suggested that vegetation on Mars is red instead of verdant—that in this distant and miniature world the poet may sing of spring, more truly than our terrestrial poets, that

She cometh blushing like a maid.

As respects the absence of forests, we may perhaps find a sufficient explanation in the fact that lofty trees would exist under somewhat unfavourable conditions in Mars; for gravity being so much less than on our own earth, the stability of objects having equal dimensions would be correspondingly reduced. On the other hand, the winds which blow in Mars are probably, as Professor Phillips has pointed out, exceedingly violent; so that to quote a striking paper which appeared long since in the *Spectator* (in a review of my "Other Worlds"), "if currents of air in Mars are of more than usual violence, while the solidifying force of friction which resists them is much smaller than here, it may be a reasonable inference that "natural selection" has already weeded out the loftier growing trees, which would stand less chance in encounters with hurricanes than our own." The absence of prairies is not so easily explained, however; and the idea is, in fact, suggested that some of those regions which have hitherto been included among the Martial seas, are in reality regions richly covered with verdure. Nor are we wholly without evidence in favour of this view; for there is a certain very wide tract in Mars respecting which Mr. Dawes remarked to me that he found himself greatly perplexed. "At times," he said, "I seem to see clear traces of seas there; but at other times I find no such traces." These regions have accordingly been regarded as extensive tracts of marsh land. But the idea seems at least worth considering that they may be forest regions or extensive prairies.

There must needs be rivers in Mars, since the clouds, which often cover whole continents, must pour down enormous quantities of rain, and this rain-fall must find a course for itself along the Martial valleys to the sea. Indeed, we can have no doubt that Mars has been the scene of volcanic disturbances like those to which our own mountains, hills, valleys, and ravines owe their origin. The very existence of continents and oceans implies an unevenness of surface which can only be explained as the effect of subterranean forces. Volcanoes must exist, then, in Mars; nor can his inhabitants be wholly safe from such earthquake throes as we experience. It may be questioned, indeed, whether subterranean forces in Mars are not relatively far more intense than in our own earth,—the materials of which the planet is formed being not only somewhat less massive in themselves, but also held down by a gravity much less effective.

It would seem, also, that the Martial oceans must be traversed by currents somewhat resembling those which traverse our own oceans. There is, indeed, a very marked difference between our seas and those of Mars. For apart from the circumstance that the terrestrial oceans cover a much greater proportion of the earth's surface, the Martial seas are scarcely traversed by appreciable tides. Mars has indeed two moons, but neither can appreciably sway his ocean waters, and though the sun has power over his seas to some slight extent, yet the tidal waves thus raised would be very unimportant, even though the seas of Mars were extensive enough for the generation of true tidal oscillations. For, in the first place, Mars is much farther from the sun, and the sun's action is correspondingly reduced—it is reduced, in fact, on this account alone more than threefold. But further, Mars is much smaller than the earth, and the dimensions of our earth have much to do with the matter of the sun's tide-raising power. Every one knows how the explanation

of the tides runs in our books of astronomy and geography. The sun is nearer to the water turned directly towards him than he is to the centre of the earth; he therefore draws that water away from the earth, or in other words raises a wave; but again, says the explanation, the sun is nearer to the earth's centre than to the water on the side turned away from him, and therefore he draws the earth away from that water, or a wave is raised on the further as well as on the nearer side of the earth. If the earth were smaller, the sun would not be so much nearer to the water turned towards him, nor so much farther from the water turned away from him—so that both waves would be reduced in dimensions. Applying this consideration to the case of Mars, whose orb is much smaller than the earth's, we see that any tidal wave raised by the sun in Martial seas must needs be of very small dimensions.

But the existence of ocean currents appears to depend very little on the presence of tidal waves. In the Mediterranean Sea, the Red Sea, and the Baltic Sea well-marked currents exist, although the tidal wave scarcely affects these seas. Sea-currents would indeed seem to be due to the effects of evaporation taking place extensively over certain portions of the sea surface; and we know that evaporation must proceed very freely in the case of the seas of Mars, since clouds form so marked a feature of his atmospheric economy. We may conclude, therefore, that his seas are traversed by currents, and further that most of those effects which our students of physical geography ascribe to ocean currents, take place also in the case of Mars.

Summing up the results here considered, we seem to recognise abundant reasons for regarding the ruddy planet which is now shining so conspicuously in our skies as a fit abode for living creatures. It would seem, indeed, unreasonable to doubt that that globe is habitable which presents so many analogies to our own, and which differs from our own in no circumstances that can be regarded as essential to the wants of living creatures.

THE MORALITY OF HAPPINESS.

By Thomas Foster.

CARE OF OTHERS.

(*Continued from p. 284.*)

BUT we recognise the necessity of a more thorough altruism than that which merely considers the rights of others. That a community should progress as it ought, each member of the body social should feel that it is a part of his personal duty to consider the wellbeing of the rest. The weakness and the want of skill, the ill-health and the imperfect education of his fellows are injurious to him and to all. In such degree as weakness or want of skill affect the productive power of some members of the community, the comfort and happiness of the stronger and more skilful are affected. The weak and inefficient members, who cannot provide for themselves, must be provided for somehow. The trouble to the community which would arise from any plan for leaving the weak and unskilful unprovided for, would be much more serious than the loss arising from the efforts made to help them. But these efforts being so much deducted from the general efforts of the stronger and more skilful members of the body social must be counted as loss. So that it is the interest of all to see that there may be as few weak and unskilful persons in the community as possible.

In like manner the sickness of our fellows is a matter in which we are interested. Apart from the necessity of restoring the sick to such health and strength as may fi them to take their part in the work of the community, the illness of others may bring illness to ourselves. Fever and pestilence, though they may first attack the weak, presently extend their attacks to those who had been strong. If even a man should feel no anxiety on his own account, those dear to him, those dependent on him, or those on whom perhaps he is in greater or less degree dependent, may succumb to such attacks. Considering all the evils, near and remote, which may follow from an epidemic, we recognise the necessity of adopting all such altruistic measures as may avail to diminish the chance of such diseases arising, or to limit their range of action when they have once found footing. No doubt egoistic considerations here seem to suggest altruistic duties; but these altruistic duties cannot be properly undertaken or discharged unless they have become habitual and are referred to a real care and regard for others independently of consequences, more or less remote, to self. Apart from which, the discharge of such altruistic duties will be more satisfying and more pleasant if they are spontaneously undertaken.

Similar considerations apply to education in all its various forms. In other words, we must consider the mental as well as bodily weaknesses, and the mental as well as bodily diseases, of our fellow-citizens. Where those around us are stupid and unintelligent, where they attempt no improvements, where they have little inventive capacity and little readiness to use even such as they have, we suffer along with them. The mere stupidity of the great mass of most communities with regard to the system of Government they consent to be ruled by, may mean most serious injury and discomfort to all, foolish and intelligent alike. Those who see what is needed, or at least the direction in which improvement may reasonably be sought, yet remain silent in the belief that it is no business of theirs, are as unintelligent as those who stupidly assent to what—without thinking—they suppose to be good for them and to be provided for by those who know better than themselves,—though often, when traced to their source, the measures in vogue are found to be of no better origin than the body itself which submits to them.

A low standard of intelligence in the community affects the welfare of all, in many different ways. Wrong ideas about the relation of the nation to other nations may seem unimportant in the case of persons who take no direct part in political matters. But in reality a very notable influence is exerted by the community generally on the conduct of those who have charge of political affairs. Wrong counsels in the cabinet may be advanced or right counsels hampered by stupidity in the country at large. Statesmen themselves are not always so wise or often so firm that they are not influenced by prevalent ideas; and so far as mere numbers are concerned prevalent ideas are likely to be foolish ideas. Fortunately mere numbers may not suffice to give weight to prevalent stupidity. Many of the unwise are influenced by the observed fact that such and such men conduct affairs successfully, and so are led to support the wiser sort, not through sound judgment on their own part, but from that kind of sense which leads the ignorant to defer to the judgment of the better-informed. But this does not prevent the average intelligence of the community from being a matter of great moment even in political matters,—supposed to be guided always by the wisest, despite the true saying that the world is governed with but a small amount of wisdom. What I have here said has no relation to the action of kings, princes, and the like, who in English speaking communities cannot now injuriously influence political relations except through the weakness or

folly of statesmen. Yet the argument might be strengthened by calling attention to the way in which, even within the last thirty years, our own country has suffered in this special direction, statesmen weakly or foolishly yielding to public pressure by which the unwise counsels of princes have been supported. A hundred years ago our country saw in still more marked way how the average want of intelligence of the many, supporting the stupidity of a king (of alien race, in that case), may go near to wreck the fortunes of a great race. We may hope however that no such trouble is in store for us hereafter as afflicted the British people when a foolish people insanely strengthened the hands of a mad king.

In social matters a low standard of general intelligence is a serious evil, which a wise altruism will endeavour to diminish. "*I do not mean*," I may here say with Mr. Herbert Spencer, "*such altruism as taxes ratepayers that children's minds may be filled with dates and names and gossip about kings and narratives of battles and other useless information, no amount of which will make them capable workers or good citizens; but I mean such altruism as helps to spread a knowledge of the nature of things, and to cultivate the power of applying that knowledge.*"

It is hardly necessary to multiply examples. We are confronted at every step by the harmful effects of prevalent want of intelligence. The fire which is intended to warm your room is so stupidly placed that it sends the better part of the heat up the chimney and creates cold draughts round your legs. Equally obnoxious to the understanding is the window by which you seek to ventilate your room. It is a struggle to open it, a struggle to close it, unless when your head is in the way, when it generally descends in effective guillotine fashion. The carpeting of your room is an absurdity, the papering (apart from any question of beauty) a monstrosity. The gaseliers are so ingeniously arranged that you get a minimum of light, and a maximum of heat and foul air. The chair you sit on seems intended to make you uncomfortable; as you draw it up to the table you find that the senseless people who plan furniture have provided sharp corners just where your knees are most likely to be caught. If you wish to lie down or to recline on a sofa, you find the head of the sofa so ingeniously padded that while too sloped for reclining, it is not sloped enough for you to lie on it comfortably.* Your child running in for a kiss from papa, stumbles over a footstool so carefully coloured like the carpet that it did not catch his eyes but his feet; and falling, is hurt severely by a sharp projection on chair, sofa, table-leg, fender, scuttle, or what not, where no sharp projections are wanted, and none ever should be. In numberless ways miseries, individually small, but effectively diminishing happiness, result from general want of intelligence. "Unpunctuality and want of system" again, as Mr. Herbert Spencer points out, "are perpetual sources of annoyance. The unskilfulness of the cook causes frequent vexation and occasional indigestion. Lack of forethought in a housemaid leads to a fall over a bucket in a dark passage; and inattention to a message, or forgetfulness in delivering it, entails failure in an important engagement."

It is thus the interest of each one of us, and being also for the good of all becomes the duty of each, to be altruistic in regard to the mental progress of the community,—"we benefit egoistically by such altruism as aids in raising the average intelligence."

But we are equally interested in the improvement of the moral feeling pervading the social body. The happiness of the whole community is diminished by the prevalence of unconscientious ways. In small matters as in large the principle prevails. We are all interested in helping to teach men the duty of considering the rights and claims of others. From the man who hustles others off the pavement or occupies an unfair share of what should be general conversation, to the man who swindles by gross aggressions or serious breach of contract, the products of a state of low average morality diminish the happiness of the community. The aggregate of discomfort wrought by paltry offences is serious though each separate offence may produce but slight mischief. Moreover offences paltry in themselves may produce very serious results. The disobedience of a nurse in some small matter (such as taking her charge to this or that place), may lead to accident affecting life or limb, or to disease ending in permanent injury or in death. In other ways, mischievous results of greater or less importance are brought about by defective moral sense in small matters, while when we consider the effects of want of conscientiousness in business we recognise still more clearly how much we are all concerned in the moral improvement of the community. "Yesterday," says Mr. Herbert Spencer, "the illness of a child due to foul gases led to the discovery of a drain that had become choked because it was ill-made by a dishonest builder under supervision of a careless or bribed surveyor. To-day workmen employed to rectify it occasion cost and inconvenience by dawdling, and their low standard of work, determined by the unionist principle that the better workers must not discredit the worse by exceeding them in efficiency, he may trace to the immoral belief" (well put!) "that the unworthy should fare as well as the worthy. To-morrow it turns out that business for the plumber has been provided by damage which the bricklayers have done." And so daily and hourly do we feel that the moral imperfections of the community are fit subjects for such altruistic efforts as may help to raise the average morality.

(To be continued.)

* I fear Mr. Foster refers to that abomination of desolation, the Alexandra Sofa, which certainly for hideousness and utter unfitness for all the uses of a sofa is a marvel of idiotic absurdity. Nine-tenths of our sofa and armchair patterns, however, are "too absurd for any use" as they say in America. Among my own pet abominations I may mention nearly all the methods (save the mark) for curtaining windows, the ridiculous ways in which looking-glasses are swung, the preposterously unscientific forms of ink-stands, and some others *quæ nunc perscribere longum*.—R. P.]

CREMATION.*

By Richard A. Proctor.

THE debate on cremation in the House of Commons afforded a singular illustration of the operation of our constitutional system on matters connected with the social requirements of the people. Mr. Herbert Spencer, in his fine article on the "Coming Slavery," points out the danger of our handing ourselves over as slaves to the body which we elect theoretically to be the servant of the body social. He shows how we have given, and propose to give, to Government, through our great Talking House, the power of regulating many social matters which should be regarded as in no way falling within its scope. We have made Government our deliverer of letters and messages, our chief carrier, the manager of our system of education, the supervisor of medical matters (even within our own households, as in the case of vaccination), and the controller of certain matters affecting morality. Every year bills for

* From the *Newcastle Weekly Chronicle*.

extending Parliamentary influence in this mistaken direction are introduced, and we imagine we are advancing where we are in reality retrograding, that we are securing fuller freedom when in reality binding ourselves under a growing slavery, and attending to the business of our country when we are really handing over our own proper business to those who cannot be nearly as much interested in seeing to its being properly done as we are ourselves.

Cremation naturally has taken its turn. It is permitted now, and every one who desires either to be cremated himself in due course, or to cremate (also in due course) the bodies of departed relatives, can make an arrangement for having his wishes fully carried out. But, of course, the advocates of cremation cannot be quite happy until their system of burial is put under Government control; so they try to get a bill passed for the regulation of cremation. So much for *their* mistake. It is but an example of the class of mistakes with which our Parliamentary system makes us yearly more familiar. The way in which their proposal is met and, as it happens, defeated, illustrates a more serious defect still in the prevalent mode of thinking about such matters. Officialism, by its representatives both in office and out of office, opposes not the regulation of cremation, but cremation itself, on grounds utterly stupid and blunder-headed, after the customary manner of officialism. The one element of sense in their opposition resides in the undoubted objection that a certain very small proportion of cases of a form of crime by which a still smaller proportion of deaths are occasioned, would possibly remain undetected and unpunished if cremation were practised. Possibly one person in 100,000 of those who die annually dies by poison. It may be that in one poisoning case out of a hundred suspicion is not aroused till after burial. In these few cases among deaths, themselves exceptional in character, detection would be prevented were cremation universally adopted as the mode of disposing of the dead; but only a very small proportion even of these would be affected so long as cremation remains, which it will always do, the exception rather than the rule. But to hear our officials in Parliament on this subject, one would imagine that at least a fourth of our deaths were due to poison, that in every case suspicion would only be aroused some time after death, and that every dead body would be disposed of by cremation if once they passed a bill for regulating what is already permitted. The other chiefly sentimental and silly objections might have been urged with greater force on the other side, seeing that they are considerations which will always render cremation unpopular, and therefore prevent its being so commonly resorted to as its enemies fear—or say they fear—that it may be.

Then besides the official and therefore (almost of necessity) the stupid objections to cremation, came the imbecile objection that cremation has been advocated on scientific grounds. Said one representative noodle—in my ignorance of party relations in our talking houses, I am unable to say whether he belonged to one or the other of the two chief parties which undertake to get us along by hauling in opposite directions—this system is a crude attempt to foist on us the fancies of men of science. Consider the inane idiocy of such a remark. What is science but the search after knowledge? What is a man of science?—if any claim this name, (for my own part I think no man of sense would ever say more for himself than that he is a student of science)—What is such a man but one who strives to learn what are the laws of nature, and what therefore is best for those whose lives are enforcedly subject to those laws? In the search after knowledge, men have found that every dead body, if left to itself on or in the ground, undergoes processes not merely analogous to those which take place if the body is burned, but actually identical with them; that even if dead bodies are absurdly dealt with so as to delay these processes, the end is the same. The process may last twenty years in a coffin, instead of the three years or so in which mother earth does the work. Or, in a stately mausoleum, the process may last two or three centuries. Or it may be lengthened to thousands of years by elaborate processes of embalming. But always there is the same final result. The study of natural laws has further disclosed the fact that in any populous community mischief of a very serious nature may arise from consigning multitudes of dead bodies to the ground in the midst of human habitations and in the neighbourhood of places (or in the very places themselves) whence the water supply of the community is obtained. That cremation is a method of disposing of the dead which would be free from such objections, has been further shown by scientific researches. Yet these facts, brought before Parliament in connection with a suggestion that this innocuous system already permitted, should be regulated by the State, is described (by one of those who get foisted upon the country as legislators for no merit but the inheritance of certain property) as a crude attempt to foist scientific fancies on the House.

As regards the future wide extension of the system of cremation, there is probably little chance of it. Too many retain the old superstition, natural enough in past times, but a sheer absurdity now, that the collection of various forms of matter which chances to be the "body" of a relative or friend is in some way distinct (beyond the influence of association) from any other equivalent collection of the same forms of matter. It is very natural and proper that after death the body should be associated in our minds with the personality of its former tenant, just as the former home of a Shakespeare or a Newton is associated with the great man who lived in it. If, without harm to the living, the body of a great man could be kept among us unchanged and unchanging, one might see reasons for so keeping it, akin to those which lead men to make statues or portraits of the dead. But when the body *has* to be disposed of, it is as absurd to consider too fancifully the method of disposal, and so be led to reject the best and safest way, as it would be if, were we forced (in some way) to dispose of Shakespeare's former house, we were to insist that the stones and timberwork should only be used for libraries and museums, and not for the homes of men and women.

For my own part, I share with Mr. Labouchere a sense of utter indifference as to what happens—I was going to say with this body of mine, but I rather hope that it will be another body, associated with me as my temporary home, which will be in question when I cease to live—(in other words I hope I may live long enough to have entirely got rid of the material particles which form my present body)—so I will say—with *that* particular collection of sundry elements which may then be my body. I am not quite so well able to rid myself of the influence of association in regard to the body of a dead friend or relative. I can understand the feeling, absurd though it is in itself, that the quick burning of the body is a less loving way of disposing of it than the form of burial which results in a very slow dissolution of whose actual nature we dare not allow ourselves to think. But that there is this natural and unreasonable feeling should be a reason rather for encouraging than opposing cremation, seeing that we have in it the assurance that the system will never be over hastily adopted.

MOVED FROM AFAR.*

I. THE EMOTIONS.

WE will select a few accounts from witnesses not likely to be accused of sentimental exaggeration :—We begin with two closely allied narratives from gentlemen of acknowledged scientific position. And we may remark in passing that men of science—who are not, of course, a large class—contribute, we think, quite their proportional quota to our collection of evidence throughout. The following case was sent to Professor Sidgwick by the Rev. J. M. Wilson, head-master of Clifton College, a senior wrangler and well-known mathematician† :—

"Clifton College, Jan. 5, 1884.

"The facts were these, as clearly as I can remember.

"I was at Cambridge at the end of my second term, in full health, boating, football-playing, and the like, and by no means subject to hallucinations or morbid fancies. One evening I felt extremely ill, trembling, with no apparent cause whatever; nor did it seem to me at the time to be a physical illness, a chill of any kind. I was frightened. I was totally unable to overcome it. I remember a sort of struggle with myself, resolving that I *would* go on with my mathematics, but it was in vain: I became convinced that I was dying.

"I went down to the rooms of a friend, who was on the same staircase, and I remember that he exclaimed at me before I spoke. He put away his books; pulled out a whisky bottle and a backgammon board, but I could not face it. We sat over the fire for a bit, and then he fetched some one else to have a look at me. I was in a strange discomfort, but with no symptoms I can recall, except mental discomfort, and the conviction that I should die that night.

"Towards eleven, after some three hours of this, I got better, and went upstairs and got to bed, and after a time to sleep, and next morning was quite well.

"In the afternoon came a letter to say that my twin brother‡ had died the evening before in Lincolnshire. I am quite clear of the fact that I never once thought of him, nor was his presence with me even dimly imagined. He had been long ill of consumption, but I had not heard of him for some days, and there was nothing to make me think that his death was near. It took me altogether by surprise.

"JAMES M. WILSON."

Our next case is also from a scientific witness, who can hardly have been tempted to exaggerate, since the experience which he thus records greatly impairs the force of the main thesis of his book, which is directed *against* the transmission of obscure influences (mesmeric and the like) from one person to another.

[*Translation of pp.* 71-73 *of* "*Der sogenannte Lebens-Magnetismus oder Hypnotismus,*" *by Dr. E. L. Fischer, of Würzburg* (1883).]

"When I was a student at the University I experienced, on waking one morning, a quite extraordinary feeling of sadness. I was not in the slightest degree unwell, and was aware of no reason for distress, and my state of depression consequently made a great impression on me—the more so that I normally enjoy the best spirits. I asked myself what could be the meaning of it, and whether some serious illness must not be impending. I made every effort to banish this deep melancholy, and especially to assume a gay demeanour in the presence of my friends; but all my efforts were unavailing. Before lecture two of them asked me what was the matter; they said I must have something heavy on my heart. During the whole forenoon I remained in this state of dismal wretchedness. All at once a telegram arrived from home, informing me that my grandmother was taken very ill, and that she was earnestly longing for me. There I had the solution of the riddle. Nevertheless from that hour my melancholy gradually decreased, and in spite of the telegram it completely disappeared in the course of the afternoon. In the evening I received a second message to the effect that the danger was over. In this way the second phenomenon, the rapid decrease of my wretchedness—a circumstance which in itself was surprising, inasmuch as the melancholy should naturally rather have *increased* after the receipt of the first news—received its explanation. For the afternoon was just the time when the change in the patient's condition for the better took place; and the danger to her life once over, her yearning for my presence had decreased; while simultaneously my own anxiety was dispelled."

We have space for but one more instance, which is any rate, sufficiently terse and business-like :—

"20, Rankeillor-street, Edinburgh, Dec. 27, 1883.

"In January, 1871, I was living in the West Indies. On the 7th of that month I got up with a strange feeling that there was something happening at my old home in Scotland. At 7 a.m. I mentioned to my sister-in-law my strange dread, and said that even at that hour what I dreaded was taking place.

"By the next mail I got word that at 11 a.m. on the 7th of January my sister died. The island I lived in was St. Kitts, and the death took place in Edinburgh. Please note the hours and allow for difference in time, and you will notice at least a remarkable coincidence. I may add I never knew of her illness. "A. C——N."

In answer to inquiries Mr. C——n adds :—

"I never at any other times had a feeling in any way resembling the particular time I wrote about. At the time I wrote about I was in perfect health, and in every way in comfortable circumstances."

If further proof be needed that we have not to go to weak or hysterical sources for evidence of these vaguer and more emotional sorts of telepathic impression, we may add that our collection includes under this head accounts from two informants who, in very different ways, have obtained the highest reputation as acute and accurate observers—Mr. Henry James and Mr. J. N. Maskelyne.

(To be continued.)

* From a most interesting and suggestive paper on Apparitions, in the *Nineteenth Century*, by Messrs. Edm. Gurney and Fred. W. H. Myers.

† Most of the informants quoted in these articles are privately known to us. But since it happens that many of them bear well-known names, we have thought it better to omit in all cases the statement of our acquaintanceship, rather than to assert it in cases where our personal attestation of confidence would have looked highly superfluous. We may add that the narratives here given are, of course, mere samples from a very large collection, which we hope soon to lay before the public in its entirety.

‡ One or two of the cases quoted by Mr. Galton of consentaneous action or thought on the part of twins seems to us to be probably referable to telepathic impressions.

THE following copy of the passage referred to in Col. Herschel's letter (KNOWLEDGE, No. 131, p. 314) has been kindly forwarded by Mr. R. Barrington :—"I applied the same test to the comet of 1862. There are various modes of making the trial. Mine was by looking at the comet through an achromatised doubly-refracting prism, and turning the prism round in its own plane. I could perceive *no* alternate maxima and minima of brightness in the images. But in this case it is the positive result which is conclusive. Everything depends, in the first instance, on the relative situations of the objects and the eye. And, moreover, the light of the comet of 1862 was far inferior to that of Donati's, rendering the experiment *pro tanto* more delicate, and it is very possible that to septuagenarian eyes, indications of *partial polarisation* might escape observation."

STANDARD TIME.*

BY J. K. REES, A.M.

ON November 18, 1883, there was accomplished virtually a reform in the Time Standards of the United States and Canada for which scientific societies and men had long been working. On account of the labour done by the American Meteorological Society, followed by the Society of Civil Engineers and the American Association for the Advancement of Science, and especially because of the prompt and very energetic work of Mr. W. F. Allen,† this reform was quietly begun. There has been but little opposition to the new standards, as their scope has been studied. The newspapers have given such full accounts of the movement that it will be necessary here to make only a short statement. In France the railroad systems are run by Paris time. The greatest difference between the true local time and the railroad time is over forty minutes. In England, Scotland, and Wales but one time is used, and that Greenwich time, while the extreme points, Yarmouth and Land's End, are thirty-two minutes apart. The adoption of one time standard for a large section of the country, and the consequent abolition of the numerous local time standards, is attended with great and obvious benefits.

So far as I know, the first person to publish any system for the United States was Professor Dowd, of Saratoga Springs, who, in 1869, published a pamphlet explaining his "hour system" for the railroads. Professor Dowd proposed to take belts fifteen degrees wide, running north and south through the country, and to have all the railroads in a belt keep the same time. These belts being fifteen degrees of longitude in width, the time standards would thus differ exactly one hour. He first started with the meridian through Washington, D. C., as his initial central meridian, but afterwards changed his system so as to connect with the meridian of Greenwich, by adopting as his initial central meridian the 75th meridian west of Greenwich.

Prof. Dowd met many of the railroad men, and, although influencing a few of the prominent railroad managers, he was not able to bring about any practical result, except, perhaps, to educate a considerable number of railroad men in the advantages of his system. In 1874 the Standard Time Committee of the American Metrological Society took up the subject, and, without being aware of Prof. Dowd's work, elaborated a system of "hour standards," basing their system on Greenwich, and dividing the United States and Canada into north and south belts. This society printed considerable matter on the subject, and through the energetic work of President Barnard, Cleveland Abbe, and E. B. Elliott, succeeded in stirring up a great deal of interest. It was through the influence of this committee that Mr. Allen became a member of the American Metrological Society. Subsequent to the beginning of the work in this society the subject was brought to the attention of the Society of Civil Engineers and also the American Association for the Advancement of Science. Many of the directors of observatories in the United States became thoroughly interested in the proposed reform, and aided materially in educating the people up to a comprehension of the scheme and its advantages.

But while the "hour system" scheme was endorsed by the majority of scientific men, yet there were those who favoured a single standard for the whole country. This standard meridian some proposed to pass through Washington, while others suggested the ninetieth meridian from Greenwich which passes about 50 seconds to the east of St. Louis. The scientists fully appreciated that the key to the solution of the problem lay in the hands of the railroads. If the railroads should adopt any system, the people would very soon follow. Therefore many attempts were made to interest the railroads, without any practical result, until the American Metrological Society interested Mr. Allen in the matter, to whom the railroads had referred the question. Mr. Allen very quickly decided that it would be of no use to press upon the railroads any single-standard system, as the country was too large; and he also decided to recommend any system that should turn out to be practically the best for the railroads without considering the scientific side of the question. In studying the railroads he soon saw that the hour system was the best, and that the roads were arranged in four belts. Roads east of Buffalo, Pittsburgh, Wheeling, &c., ran on various times, of which Philadelphia time was nearly the average. Roads in the belt between Pittsburgh and the western boundary of the State of Kansas had standards of which St. Louis time was nearly the average. Roads between Kansas City and Salt Lake adopted Denver time, and still farther west San Francisco time was used. Noticing how close to the standards suggested by the American Metrological Society his practical standards ran, Mr. Allen proposed to the railroads to adopt that plan. Making a careful study of the whole country, he selected the points at which it was feasible to change from one hour standard to another. After months of writing and incessant labour, the majority of the railroads were persuaded to join in the movement. After the railroads were secured, it became desirable to have the principal cities in the country adopt the new standard time. In our own city (New York) the writer was fortunate enough to meet with General Cochrane, of the Law Committee of the Board of Aldermen. To this gentleman the proposed change was explained, and in a subsequent meeting at the City Hall, Gen. Cochrane, with Mr. Allen and the writer, drew up a preamble and resolution embodying the change. This was passed without trouble, owing to the favourable view taken of the proposition by Gen. Cochrane, and Mayor Edson. In Boston, the action of Prof. Pickering, of the Harvard Observatory, and his assistant, Mr. J. R. Edmands, overcame all opposition, and a change of sixteen minutes was made in their local time. Since the action of these two cities, many of the large cities in the country have adopted the standards of the belts wherein they are situated.

Even after the system shall have been universally adopted in this country, the complete plan of the foremost advocates of the changes in time standards will not be carried out, for they propose encircling the globe with standard meridians fifteen degrees apart. All places seven and one-half degrees east and west of a standard meridian would approximately, governed by limitations of nationality, adopt the time of the central meridian, so that, as one should travel around the earth, he would find the local times differing exactly one hour.

Moreover, it is proposed to have what is called a Cosmic Time. The Cosmic day is to begin when the mean sun is over the meridian 180° from Greenwich. It is further proposed to do away with the A.M. and P.M. designations, and to number the hours from one to twenty-four.

Through the work of the American Metrological Society and the Society of Civil Engineers, the knowledge of this complete plan for the world has been spread abroad. The general plan has had the endorsement of the Geographical

* From the *School of Mines Quarterly*.

† Editor of the Traveller's Official Guide and Secretary to the R. R. Time Conventions.

Convention which met at Venice, the Society for the Reform and Codification of the Laws of Nations at Cologne in 1881, the Imperial Society at St. Petersburgh, the Geodetic Convention at Rome, the International Bureau of Weights and Measures at Paris, the Canadian Institute, &c., besides most of the scientific societies in this country. In order to further discuss this subject in its world-wide application, the President of the United States, acting at the request of a large body of scientific men, has called an international convention to meet at Washington in October.* Judging from the interest shown in the question by all the leading nations of the earth, we may confidently expect to see the world-wide adoption of the hour-standard system in the near future.

Reviews.

SOME BOOKS ON OUR TABLE.

The New Principia. By Newton Crosland. (London: Trübner & Co. 1884.)—"Whan," said the Scotchman, in the venerable anecdote, "ae mon talks aboot what he disna understan', till anither mon, wha disna understan' hum, *that's* Maytapheesics." *Mutatis mutandis*, this definition might well be applied to the impudent book whose title heads this notice. We use the word "impudent" advisedly, and precisely in the sense in which we should employ it in speaking of anyone who, knowing literally nothing of the distinction between nerve, muscle, and cartilage, should find fault with a surgical operation performed by Lister, Paget, or Skey; or of a man who had never seen a ship in his life, and did not know the port from the starboard side, who should criticise a naval manœuvre of Lord Alcester's. For, sooth to say, the ignorance of Mr. Crosland of the very rudiments of the subjects on which he presumes to dogmatise would be ludicrous—if it were not pitiable. Take, for an example, his wild ideas on the mode of action of a galvanic battery (p. 12); "magnetic action" *simulating* incandescence (p. 14); the consumption and disappearance of metal under this same "action" (p. 15); the conversion of electricity into light and heat by attraction! (p. 17); the *increase* of light and heat with the increase of distance of a planet from the Sun (p. 17); 'electric action" shining "most brilliantly in a vacuum" (*id*); the production of light by the friction of the "magnetic current" emanating from the sun, on our atmosphere (p. 22); as though this "current" flowed like water out of a street plug! and so on. It may suffice to show the pains that our author has taken to acquire his facts from the latest and best sources if we say that his "authorities" for astronomical data are (pp. 38, 39, and 41) "Ferguson's Lectures" (originally published in 1756); Joyce's "Scientific Dialogues," 1825 (a curious mixture of facts and nonsense); Milner's "Gallery of Nature" (a publisher's compilation some forty years old); Lardner's "Astronomy" (published 1855)—Lardner, as is well known, having scarcely ever written a thousand original lines in his life; and Bonnycastle's "Astronomy," a little book compiled by a schoolmaster in 1823. Of any more recent or trustworthy astronomical literature, Mr. Crosland appears to be in the most sublime ignorance. Otherwise he would scarcely have spoken (on p. 8) of the Sun being "a dark globe"; of "centrifugal *force*"; of a "burst planet" (pp. 59 and 60); of the absence of heat on the moon (70), &c., &c. An excellent illustration, too, of his keen appreciation of facts, and of the care he has taken to ascertain them, may be found on p. 43, where he says, "We may be quite sure that a planet which takes thirty years to revolve round the sun moves at too slow a pace to manifest any centrifugal force whatever." Would Mr. Crosland be surprised to hear that Saturn (which, with its period of 29·46 of our years, is obviously the body to which he refers) travels in its orbit with a velocity of 5·95 miles *per second*, or more than twenty-five times as fast as the shot when it is leaving the muzzle of the eighty-ton Armstrong gun? What sort of cord would hold a weight whirled round the hand with the merest fraction of this velocity? But we might fill a page or two of Knowledge with similar exhibitions of almost childish ignorance; though, in mercy to our readers, we forbear. We differ so utterly from the author, that it is a relief to find a subject on which we can agree. He says on p. 82, "I am quite aware that my style of controversy may be termed conceited, arrogant, contemptuous, and impertinent." So far we are in the most entire accord with him.

A Chapter of Science. By J. Stuart, M.A. (London: Society for Promoting Christian Knowledge.)—Opening Mr. Stuart's charming book, after wearily wading through Mr. Crosland's dreary rubbish, is like quenching one's thirst at a crystal spring, after a futile attempt to swallow a few mouthfuls of water from a muddy puddle. It would seem from the preface that Mr. Stuart delivered a course of six lectures, in the year 1868, to the artizans in the London and North-Western Railway Company's works at Crewe, and it is a reprint of them which forms the "Chapter of Science" before us. They appear to us to be the very model of what such lectures should be. Notably is this the case in the exposition of the Laws of Kepler and Newton, which form the subject of Lectures II., III., and IV. For lucidity of explanation we have so far met with nothing to surpass them, and it certainly would seem that our author's original audience must have possessed an amount of intelligence strangely inferior to that of the average British artificer if they failed to apprehend clearly and thoroughly the meaning and nature of the laws which govern not only our own solar system, but the whole visible universe. An excellent popular description of spectrum analysis, too, is given in Lecture V. As a cheap, simple, and absolutely trustworthy introduction to the study of gravitational astronomy, for those ignorant of mathematics, it would be very difficult to find a book to surpass this one of Mr. Stuart's.

The New Atlantis, or Ideals Old and New: A Dialogue, By a Disciple of Buckle. (London: Williams & Norgate. 1884.)—This curious book requires at least a couple of perusals before its full signification can be appreciated. The major part of it takes the form of a series of dialogues between a supposititious "Draper" and an equally imaginary "Lessing." In these conversations the philosophies and theologies both of the ancient and modern world are discussed, and the absolute community of all that is good or worthy in them insisted on. Very curious will it appear to the reader, approaching the consideration of the subject for the first time, to learn, by verbatim extracts from the sacred books of the Chinese, Buddhists, Brahmans, Parsees, Greeks, Romans, and the comparatively more modern Mohammedans, how much that is claimed as essentially distinctive in Christianity is now held, as it has been held in the dimmest ages of the past, by unnumbered millions whom we are but too prone to contemptuously class as "Heathen." The "Disciple of Buckle" looks to America as the home of that greater future civilisation which has yet to come.

* It is to be hoped that this date will be changed to a much earlier one.

Aura Dynamica: Concerning Force, Impulse, and Energy. By JOHN O'TOOLE. (Dublin: Hodges, Figgis, & Co.)—This is an attack on the terminology of modern Kinematics from a metaphysical point of view. So far as we understand Mr. O'Toole, his quarrel is less with the doctrine of energy, as now developed, than with the somewhat slipshod way in which its expositors express themselves; and he certainly has culled a series of examples from admitted authorities, which seem to exhibit them as floundering in a sea of verbiage. Their seeming inconsistencies are doubtless susceptible of explanation, in some cases so readily so as to render Mr. O'Toole amenable to the charge of hypercriticism; but anything which tends to render the use of language more definite and precise, *ipso facto* contributes towards the advance of knowledge. Meanwhile, what is irreverently known as the $(t + t')$ school is quite capable of taking care of itself.

Hints to House-hunters and Householders. By ERNEST TURNER. (London: T. Batsford. 1883.)—A thoroughly practical and very useful book, dealing as it does with the details of construction of every part of a dwelling-house, from the attic to the basement. Nothing is more commonly heard from the lips of house-hunters, after a visit to view some place which they may think of taking, than "Oh! I utterly forgot. . . so and so." With Mr. Turner's handy manual in his possession, no intending occupier can have any excuse for such forgetfulness, inasmuch as everything that can be required (as well as certain things which distinctly are *not* required) in a really healthy, habitable house, will be found set forth in detail. There are but few householders, indeed, who may not learn something from the work before us.

Wholesome Houses. By E. G. BANNER, C.E. (London: Edward Stanford. 1882.)—Mr. Banner is the inventor of a very ingenious and effective method of ventilation, and it is to show its applicability to the rendering houses wholesome that his book is written. Sufferers from sewer-gas and cognate evils of defective drainage may study it with advantage.

Is God Unknown and Unknowable? By the Rev. C. E. BEEBY. (London: Wyman & Sons. 1884.)—This is, in effect, a sermon, neither better nor worse than the average of the 104 preached during the preceding twelve months in the church or chapel which the reader himself attends.

THE installation of the Gülcher Electric Light Company (Limited), at the Crystal Palace, is now working successfully, and effectually lights the central nave. The installation consists of 75 arc lamps of 2,000 candle-power (nominal) each, connected in multiple arc, and fed by the current from three Gülcher dynamos, No. 5 type, running at 500 revolutions per minute. There are four dynamo machines, connected parallel, and so arranged that the difference of potential at the terminals of each machine is kept constant. Provision is also made for the switching-off of any one working machine, the spare machine being substituted without stopping the light. The current generated is led in a pair of main wires to a switch-board, where it is divided into the necessary number of circuits, each circuit at this point being provided with a fusible plug. Arrangements are made at the switch-board for measuring the current without disturbing the light. About 80 horse-power is said to be absorbed. The lamps are suspended by the cable which carries the current, and are provided with counter weights to facilitate the raising and lowering of them. There are 54 lamps in the great nave, 12 in the orchestra, and 8 in the opposite transept. The lamps require 8 ampères each, and a terminal potential of from 65 to 70 volts is maintained at the machines. The lamps burn very steadily, and the illumination of the various objects of interest on view in connection with the International Exhibition now proceeding is effective and complete. We hear, says the *Electrical Review*, that the Crystal Palace Company has it in contemplation to extend the use of the electric light to the whole of the courts and galleries at the Palace, so satisfied are they with their arrangements with the Gülcher Company.

OPTICAL RECREATIONS.

BY A FELLOW OF THE ROYAL ASTRONOMICAL SOCIETY.

(*Continued from p.* 307.)

WE have spoken in the last paper of Galileo's idea of measuring the rate at which light travels, by the extinction of lanterns by a couple of observers a mile or two apart, and of its inevitable and hopeless failure. But the velocity of light has been measured more recently by terrestrial observation, and that with a degree of accuracy little short of marvellous. Fizeau, the French physicist, was the first to devise anything like effective means of doing this. His method may, perhaps, be understood if we say that at a distant station a mirror is placed, to which the light of a lantern is directed from the observer's station. The reflection of this light (which has obviously travelled over double the distance between its source and the mirror) enters the observer's eye through a rectangular slit, corresponding with one in front of the lantern. In front of these slits rotates a wheel with radial teeth, long enough to cover them. Let us suppose that the observer looks between two of the teeth of the wheel at rest. He will see the light of his lantern reflected from the distant mirror. Now let the wheel begin to turn; then, as each tooth passes in front of the lantern, it will cut off its light, so that there will be a succession of flashes between the teeth, which will travel to the mirror and come back again. When we come, by-and-by, to treat of the human eye, we shall find that a luminous impression is retained by it for about the tenth of a second; so that, up to a certain point, the observer will see a continuous image. Evidently he will do so if the light comes back so fast from the mirror that a tooth of the wheel has not had time to get in front of the observer's eye. If, though, we imagine the wheel to turn with such extreme rapidity that the interval between two teeth, through which the light set out on its journey towards the mirror, is replaced by a solid tooth when such light just gets back to it, the observer will simply perceive darkness. The exact rate of rotation of the wheel being measured, and the distance between the light and the mirror known, the velocity of light is obtained by doing a multiplication sum. In practice the wheel rotates with its teeth in the focus of a telescope; the mirror is placed in the focus of a second telescope, so that the rays can be caused to return by the precise route they originally took; and there is an arrangement by which the light passes through the focus of the observer's telescope without reaching his eye, until it has fallen on the distant mirror. The difficulty of determining the exact rate at which the wheel is turning when the light suffers total eclipse (such rate being susceptible of very decided variation without the light reappearing) is a distinct drawback to this form of apparatus. Nevertheless, in a modified form, it has since been employed by Forbes and Young, and by Cornu. Fizeau placed his reflecting mirror 5·383 miles from his source of light and revolving wheel, and found the velocity of light to be 195,114 miles per second. This is now known to be too great. Cornu's subsequent determination with an improved form of Fizeau's apparatus gave 186,663 miles per second. It is, however, to the beautiful apparatus devised by Foucault that we are indebted for our most trustworthy determination of the rate at which light travels. This may be shortly described as a rotating mirror, and a distant fixed concave one, the centre of its concavity falling on the axis of rotation of the moving one. The light falling on the rotating mirror is reflected to the concave one and back again. Here, again, the light comes back accurately by its original route, until the moving

mirror rotates with such velocity that it has shifted its place by the time the light returns to it, when the image of such light will seem to be displaced. Knowing the rate at which the mirror is rotating and the angle subtended by the real and reflected images, a little very easy trigonometry enables us to calculate the velocity of light. Michelsen, of the United States navy, by the aid of this form of apparatus, found that light travels 186,377 miles in a second. Other determinations have been made; but, as a final result, Glazebrook (in his "Physical Optics") adopts as the velocity of white light in vacuo 186,771·4 miles per second.*

But, now, what *is* this invisible agent, travelling in straight lines from the object emitting or reflecting it at this stupendous rate towards the eye? Two answers—and two only—seem possible. The first was that given by Newton, who supposed that actual material elastic particles (or, as he called them, "corpuscles") of inconceivable minuteness were emitted by the luminous body with immeasurable velocity, which corpuscles entered the eye, and, impinging on the retina, produced the sensation of vision. This hypothesis certainly does suffice to explain a very considerable number of observed optical facts; and nothing is more remarkable than the ingenuity with which its author employed it to account for them all. In this he so far succeeded that men like Biot and Sir David Brewster actually held by this theory of emission up to the date of their comparatively recent deaths. We have just said that the emission or corpuscular theory sufficed to explain a very large proportion of observed optical facts; but it failed in others. Very notably did it break down in the explanation of a phenomenon of which we shall subsequently speak—the production of darkness—by two beams of light quenching each other. It was only by a curious straining of probability, too, that Newton accounted for what are now known as "Newton's Rings"—a phenomenon observable at the point of contact between the spherical surface of a lens and a plate of plane glass on which it is pressed, as also in a soap-bubble on the point of bursting. Both Huyghens and Euler conceived that space must be filled by some medium, the production of waves in which produced the sensation of light; but the vast authority of Newton silenced them, and it was reserved for Dr. Thomas Young, at the beginning of the present century, to advance and develop that Undulatory Theory of light which is now universally accepted. If we strike a stretched wire at one end, or shake the free end of a rope, or of a carpet, whereof the other end is fixed, a series of waves, undulations, or vibrations travels along these bodies respectively. There is no movement of translation of their solid particles; it is the form of the wave alone that traverses them. The particles themselves simply move up and down. The manner in which the wave-form may have its origin in such oscillations will be understood from Fig. 3.

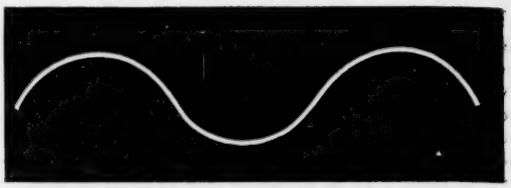


Fig. 3.

The student must cut a narrow slit in a strip of thin, black card, of the size and shape of Fig. 4. Placing now the slit in coincidence with one of the narrow ends of Fig. 3, *i.e.*, square to the length of that figure, and drawing it along such length, while preserving the slit parallel to its original direction, the white spot visible through it will be seen to oscillate in a pendulum-like path; the aggregation of these oscillations obviously making up the waves in our diagram. *What* the medium is in which the light waves are propagated is, in the existing state of our knowledge, a profound mystery. It fills space, it penetrates every body, solid, liquid, and gaseous, existing equally in the most perfect vacuum producible. The phenomena of light point rather to a solid constitution of the so-called "ether" than to a fluid one, and there are mathematical reasons (whose exposition, however, is wholly foreign to the object of the present series of papers) for supposing that the undulations or vibrations in it—which certainly are transverse to the direction of propagation of the rays of light—occur without any interchange of place among the molecules of the ether, which never seem to depart by any measurable distance from their own special localities in space. We shall take occasion, as we go on, to show how beautifully the undulatory theory accounts for the most diverse optical phenomena; and how it has enabled previously wholly unsuspected phenomena to be confidently predicted, with the result that observation has absolutely and accurately justified such prediction.

Fig. 4.

(To be continued.)

* Many recent text-books make a cheap display of learning by giving all these quantities in mètres. Written, however, as KNOWLEDGE is, by Englishmen for the English-speaking races, we have preferred to adhere to a standard of length recognised wherever our language is read or understood.

THE AMATEUR ELECTRICIAN.

BATTERIES.—IX.

SOME of our readers ask, Is the current produced by a dynamo machine the same as that generated by Bunsen cells, and how many such cells when used for electric lighting will produce the same candle-power as a dynamo? This question, or another similar to it, rises to the lips of everyone who gives but the briefest consideration to the subject. Our readers will probably remember that in the series of articles on "Electrical Measurement" (see KNOWLEDGE, Nos. 51, 55, and 58), the applicability of batteries

to electric lighting was discussed somewhat fully, and we showed that any desired current could be obtained by calculated combinations. Let us suppose, for example, that the carbon filament in a given incandescent lamp requires, to yield a light of 25 candle-power, a current having an electro-motive force of 50 volts, and a current-strength of 1·25 ampères, the resistance of the hot filament being 37·5 ohms.

Now a Bunsen cell has an E.M.F. (electro-motive force) of 1·9, or say 2 volts, the internal resistance for one of about quart capacity being ·1 ohm. Clearly to produce a current of 50 volts we shall require at least 25 cells, the resistance of which will be, let us say, 2·5 ohms (·1 × 25). By Ohm's law the current flowing through a given circuit is equal to the E.M.F. of the generator divided by the total resistance of the circuit. Whence we get

$$C=\frac{E}{R}=\frac{50}{2\cdot5+37\cdot5}=\frac{50}{40}=1\cdot25 \text{ ampères.}$$

Here, then, we have all that is required, although it would not be by any means an economical arrangement. By doubling the size of the battery plates, or by joining two sets of 25 cells side by side or in parallel circuit (Fig. 1, A B), so as to reduce

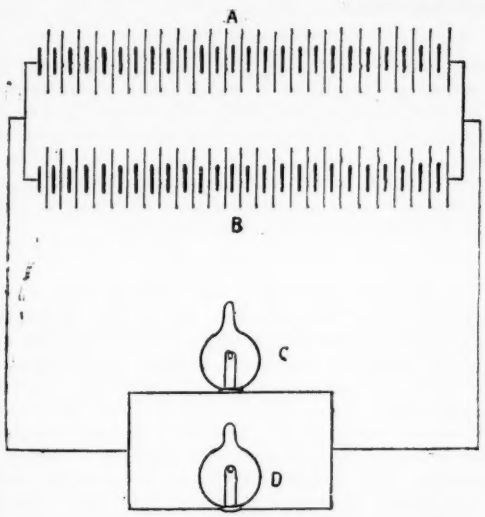


Fig. 1.

the total internal resistance of the battery to 1·25, we can place two lamps (C D) in parallel circuit, and obtain a luminosity of 25 candle-power in each lamp. The joint resistance of the lamps will be 18·75, or exactly half the resistance of one lamp, because we in reality give the current two equal channels of transmission. We then get

$$\frac{50}{1\cdot25+18\cdot75}=\frac{50}{20}=2\cdot5 \text{ ampères.}$$

the E.M.F. remains at 50, because the size of the cell does not affect it. The current of 2·5 ampères divides equally between the lamps, 1·25 going through each. Although the whole current has to encounter in the external circuit but 18·75 ohms, it must not be forgotten that each half of the current has to overcome 37·5 ohms, otherwise, less than 50 volts would suffice, and our purpose would be accomplished by reducing the number of cells.

To feed an arc lamp which requires an E.M.F. of, say, 80 volts, and a current strength of 10 ampères, the resistance of the arc, lamp, coils, and connecting wires being 4 ohms, 40 Bunsen cells will be necessary. The internal resistance of the cells being 0·1 each, we get

$$C=\frac{E}{R}=\frac{80}{4+4}=10 \text{ ampères.}$$

But 25 Bunsen cells will illuminate two incandescent lamps almost as well as they will one lamp.

Thus $\frac{50}{2\cdot5+18\,75}=2\cdot35$ ampères,

or 1·175 ampères per lamp.

Were we to join two arc lamps in parallel circuit, and feed them with 40 Bunsen cells, we should get

$$\frac{80}{4+2}=13\cdot3 \text{ ampères,}$$

or only 6·6 ampères per lamp, instead of 10. This follows because with incandescent lamps the battery resistance is low when compared with the lamp resistance, when only one or two lamps are in circuit. This simple arithmetical cause does not operate in the case of arc lamps, because the external resistance is also low. To feed two arc lamps in "series" we should obviously require 80 cells to yield an E.M.F. of 160 volts.

To compare more effectually a Bunsen battery with a dynamo, we will choose a Brush machine, which shows up the superiority of the dynamo over the battery for arc lighting. In the course of a series of measurements it was found that the internal resistance of a certain 16-lamp machine was 10 55 ohms, the resistance of the 16 lamps (joined in series), together with their arcs and the wire connecting them with the machine, being 72·96, let us say 73 ohms. The total resistance in the circuit was, therefore, roughly, 83·5 ohms. The E.M.F. produced was 839 volts, and the current in the circuit:—

$$\frac{839}{83.5}=10 \text{ ampères.}$$

To produce this E.M.F. would require at least 420 cells, which, if they were chosen similar in size to those previously referred to, that is with an internal resistance of ·1 ohm per cell, their total resistance would be 42 ohms. But only 10·55 can be permitted to enable them to give a current equal to the dynamo, consequently the cells will have to be quadrupled in size, or else four sets of 420 cells joined in multiple arc. This number (1,680), at 5s. per cell, would cost £420 at the outset, not to mention the expenditure for acids, which would be very considerable. Any one who has read our remarks on the Bunsen cell (KNOWLEDGE, No. 88), together with the eighth article on Batteries (KNOWLEDGE, No. 114), will see at a glance the practically unsurmountable obstacles to the substitution of Bunsen or any other cells for the dynamo. To compete with a Crompton-Burgin or any other large incandescent dynamo, feeding 500 incandescent lamps, each cell, if we wished to use a single series of, say, 25 cells (to produce 50 volts E.M.F.), would have to be about 83 times the size of the cells offering ·1 ohm resistance, or, if these latter cells were to be joined up in parallel circuit, we should require 2,075 cells.

It is hoped that what has here been said will, in conjunction with the articles referred to, effectually demonstrate the very restricted sphere to which chemical batteries are confined.

To return to the discussion of the various forms of battery useful and available, we may take up the thread with the "Edco," which belongs to the Bichromate class, and was introduced by the proprietors of the Griscom Motor for driving that little piece of apparatus. The battery consists of a wooden box, lined with lead (which is practically unassailable by the constituents of the cells), a leaden partition dividing it into two distinct cells. The size of each cell is

12 in. high by 6 in. long and 8 in. wide. The carbons, of which there are two in each cell, are fixed, the zincs (which dip into porous pots) being attached to a cover, capable of being removed. The plates are 10 in. long by 6 in. wide, and ¼ in. thick. The outer solution consists of 3 lb. of sulphuric acid, 1½ lb. of bichromate of potash, dissolved in six pints of water. The porous pot is filled with dilute sulphuric acid. It is claimed that the battery has an E.M.F. of two volts per cell, and that on short circuit it gives a current of 5 ampères, which means that the internal resistance is $\frac{2}{5} = .4$ ohm per cell. The battery, it is said, may be relied upon to give a steady current for sixty consecutive hours, but a recommendation is added to re-amalgamate the zincs every ten or twelve hours, which rather detracts from its value. This may, we opine, however, be easily overcome by placing a few ounces of mercury at the bottom of each porous cell, and so allowing the zincs to amalgamate themselves as they do in the Fuller cell (see KNOWLEDGE, No. 112).

In passing we may observe that where there is a large area occupied by the zinc, as in the case of the bottom of a cylinder, a very handy method of maintaining the amalgamation is to cut or turn, in a suitable piece of dry wood, a shallow groove a little wider than the thickness of the zinc, and, after well painting it all over with shellac varnish, to run in a little mercury. The zinc may then be stood in the mercury, and the amalgamation will be maintained, at least until the supply of mercury is exhausted.

ERRATA.—The corrected proof of article on the Patent Act of 1883 was unfortunately returned to the editor instead of the publishers, and so arrived too late to be used. The following alterations should be made (one or two others, as *facto* for *facta*, &c., are obvious) :—P. 325, first col. l. 19, for "proceeding" read "producing"; l. 38, for "them" read "themselves."

J. B. ROGERS'S ELECTRIC LIGHT AND POWER COMPANY (LIMITED).—Vice-Chancellor Bacon recently made an order for compulsory winding-up on the petition of Messrs. W. T. Glover and Co., creditors of the company. The company's property was in the possession of a receiver. The company did not oppose. This is the company which was to have set the world on fire with the J. B. Rogers's brass ball "accumulator," or, as it has been more properly styled, the "universal binding-screw."

CAPTAIN SHAW expresses a very favourable opinion of the Liquid Fireproof Cyanite. He states that a packing-case coated with two coats of Cyanite (the top inner half also coated with oil paint) offered great resistance to flames, "after which the fire inside died out of its own accord without destroying the case." He afterwards split open the planks with an axe, and found that only the inside surface was charred." A small flight of wooden stairs painted with Cyanite "resisted strong flames well, and practically was not weakened by them." He considers that Cyanite would be found most useful in preventing the spread of fire, and that "wooden stairs coated with it would be much safer than stone."

AN INDUSTRIAL USE FOR ELECTRICITY.—M. Henri de Parville calls the attention of wine-growers to the services electricity might render them in protecting their vines from the disastrous effects caused by a sudden fall in temperature. For several years past vines in France have been protected from the effects of cold winds or sudden changes in the temperature by artificial clouds of smoke, produced by the burning of tarred straw and other combustibles. Vine-growers have learned to appreciate the benefits of this system, but to light the fires at the right moment in the night-time, it is indispensable to have a thoroughly reliable watcher. By the aid of electricity the safety of the vines would be ensured. A vine-grower has only to place in his vineyard one or more electric batteries similar to those used to fire mines, the wires being connected with the fires prepared at regular distances. When the thermometer falls towards zero, by means of a very simple arrangement it causes the electric current to pass along the wires, the fires are lighted, the air being filled with the protecting smoke-clouds. M. de Parville cites one or two instances in which his system has been most successfully employed, with very little outlay to the vine-grower.—*Electrical Review.*

Editorial Gossip.

SCARCELY ever has a more appalling disaster at sea been recorded than the loss of the *State of Florida* and the *Ponema*. The details indeed will not bear to be dwelt upon, scarcely even to be thought of. Turning from them to the collision itself, could there have been a more striking illustration of the inadequacy of the method of lighting adopted for our ocean steamers? One half of the strength of each side light is carefully taken off by the use of coloured glass, as though with no other object but to increase the chances of collision! Not a sign of the actual course of the swiftly moving steamer is afforded by her lights! Because theoretically a certain method of lighting ought to make steamers nearly safe, the method is adhered to though over and over again it has been proved inadequate for safety. The finest ocean-going steamer in the world is not safe against such collision as sank the *State of Florida*. Yet at an expense which would be a mere nothing compared with the value of the steamer itself, to say nothing of the lives entrusted to her, collisions might be rendered all but impossible.

IN an article commenced this week, I indicate one plan (among several available) by which ocean steamers could be thus ensured against the danger of collision, by a method of lighting which would in the first place show a steamer at least twice as far off as the present system, and in the second—which is of far more importance—would indicate her distance, course, and every change of either, as clearly on the darkest night as if it were broad day.

I WAS astounded to find in the table of contents that "Our Night Sun" was included; for though KNOWLEDGE aims at originality of thought and variety of subject, yet a night sun appeared rather too original, and suggested a quite unexpected departure from all that has heretofore been observed. I was relieved to find that the heading itself was correctly given. Doubtless it was transcribed rather hurriedly by whomsoever it may be to whom the preparation of the table of contents is entrusted, and so the marvellous phenomenon of a "night sun" appeared among the contributions to KNOWLEDGE.

I HAVE received quite a number of communications, asking whether the signs ♎ opposite the earth's place in spring and in autumn, at p. 310, should not have been interchanged. They are, however, correctly placed. The notion seems to be that ♈ is necessarily the spring sign and ♎ the autumn sign; but this is only the case when we are considering the sun. He enters the sign Aries at the vernal equinox, and the sign Libra at the autumn equinox; but the diagrams at pp. 310, 311, like all plans of the planetary orbits, are heliocentric,—that is the planetary positions are referred to the sun as centre. Now from the sun as centre the earth enters Libra at the time of the vernal equinox and Aries at the time of the autumn equinox. Therefore in any heliocentric chart ♎ is the sign for spring and ♈ for autumn.

I MAY remark that the charts at pp. 310, 311, are reduced from some which I published as far back as 1867. I used the same method of giving two charts—the only satisfactory way of presenting the solar system—in the

illustrations to my article on "Astronomy" in the edition of the "Encyclopædia Britannica" now issuing.

SEVERAL suggestions have been made as to plans for showing the positions of the planets usefully. But the difficulty of the problem has not been fully recognised. It will be obvious that in the case of the diagram on p. 310 the chief difficulty resides in the circumstance that the positions of Mercury and Venus vary rapidly; whereas, in the case of the diagram on p. 311, the outer planets change so little in a month, or even a year, that it is hardly worth while to give diagrams at short intervals. I think my only course is to deal separately and often with Mercury, Venus, and Mars; and to give one diagram for the next ten or twelve years in the case of the outer planets. Even so the drawing of lines of sight, &c., must be left to the student, as otherwise most confused diagrams would result,—at least if all such lines as *might* by any chance be wanted were drawn in.

I FIND it is the general feeling, as certainly it is my own, that Mr. Ossipoff Wolfson has done as much as is desirable in the way of making it abundantly clear to all why the Polyonymous founder of the Zetetic Astronomy started that amazingly childish system and described the absurdly impossible experiments in which his few astronomical followers believe. Any astronomical absurdity may be safely trusted to impress the foolish,—and the flat earth has probably served its inventor well. But now we know why it was invented we care to know no more. We do not want a disproof of the flat earth from any one, seeing that no one with an average allowance of brains believes in it; and no amount of proof would avail with one who has not that average. Certainly we were not expecting any disproof from Mr. Wolfson, who as a former believer in it, is *ipso facto* disqualified. If Mr. Hampden should ever lose faith in Zetetic Astronomy we should not ask him—of all men—to point out its absurdity. A man who at sea had taken land for a cloud long after every one else on board had seen houses and trees on it, would not be exactly the person to whom one would turn for disproof of the cloud fancy.

MR. IRVING has made some excellent comments on the effect of an appreciative audience upon an actor. He might have gone so far as to say that an actor's real power is never known by those who have only seen him when before a cold or dull assembly. It is much the same with the actor as with the lecturer. I know that, in my own case, my audiences have very much to do with the lectures I give. Who can be enthusiastic before a thin and unappreciative audience? One might as well try to warm oneself at a wet blanket.

MR. A. C. RANYARD, an authority, as our readers know, on the subject of meteors and meteorites, would be obliged if General Norgate would forward to him (to the office of KNOWLEDGE, marked "for Mr. Ranyard") the piece of stone whose fall is recorded at p. 336, under the heading "A Strange Incident."

I LOVE a joke, even when it tells against myself,—and I have a very good one now. A kind friend, of the theologically good-natured sort (he uses a disguised hand, and has apparently taken my address from the list of Fellows of the Royal Astronomical Society, at any rate he uses an address six years out of date), sends me a cutting from the *Cheltenham Examiner*,—a letter, to wit, probably written by himself. Now I thought I had pleased and hoped I had instructed my charming Cheltenham audiences. I had done my very best, and if they had most anxiously desired to make me think they were content they could hardly have done more than they did, by close attention and apparently quick appreciation of explanations, descriptions, and illustrations. But "*surgit amari aliquid.*" Here comes "J." (whom, but for the admission of his letter into the *Cheltenham Examiner* I should have inferred to be the local lunatic at large), who thinks that I must have been laughing in my sleeve, and saying "How very easily that Cheltenham audience was satisfied."

THIS "J." literally expends himself or herself, in his or her wrath,—query whether feminine, and a blue jay? ("There's more *to* a blue jay," says Mark Twain, "than any other creature. He has more moods and more different kinds of feelings than any other creature; and whatever he feels he can put into language; and no mere commonplace language either but rattling out-and-out book talk—and bristling with profundity—just bristling." My "J." *must* be a blue jay.) He or she gives the following as a stock sentence from my lectures. Observe not a word about the utter absurdity of the statements; it is only the too frequent repetition of these "truths" to which the blue "J." objects:—

> "By the help of scientific analysis we are able to detect the existence of vapour of hydrogen in the solar corona, but we are not able by the same means to detect the presence of sodium in Rigel, nor are we able to detect the presence of sodium in Betelgeux, nor can we detect it in Aldebaran: if we had been able by the help of scientific analysis to detect it or the vapour of it in Aldebaran, we might justly expect the same result would attend our observation of Rigel, and so of Betelgeux; but failing in this latter, neither can we any more indicate its presence in the two former."

THIS is the sort of thing "J." recalled "on a careful retrospect of the lectures." And apparently neither he (or she) nor the editor of the *Cheltenham Examiner* recognises how gross an insult to the Cheltenham audiences is implied by the suggestion that they could listen to such inane nonsense for five minutes.

THIS "J." had formed his own idea of what my lectures should be. He expected to be told the names of the stars, and why the sun rises (as "many of us are able to see") at different parts of the Cotswold Hills in different parts of the year, and a number of other things which an intelligent child can learn from the ordinary text-book, though to "J." they may seem worth discussing before an audience of educated persons.

THAT one who "on a careful retrospect" got such nonsense out of my lectures as I have quoted above, should imagine there was a good deal of repetition in them, is natural. But to myself whose real trouble is that each lecture of the six ranges over at least three times as much ground as I can properly cover in the time allotted to it, the charge of vain repetition is simply absurd. I had or rather gave a singular illustration of this wideness of subject only last week. A lecture had been arranged at Llanelly by Sir Arthur Stepney, who expressed a wish—after hearing it—to hear my lecture at Swansea on the

same subject. I therefore determined, that, though the syllabus and most of the pictures were necessarily the same, I would give him an entirely different lecture; and I did: I doubt if one statement out of fifty was the same even in subject matter as on the previous night. Sixteen out of forty pictures were different. Yet my subject was in both cases The Life of Worlds, and every sentence of each lecture could have been woven into one lecture elucidating that subject. I believe I could quite easily fill six hours with matter relating to the Life of Worlds alone. My wife has heard the lecture (*how* she could, I know not) many times, and not once, I venture to say, without hearing new arguments and learning new evidence.

OUR "J." grows serious over my comet lecture. I gave this at Cheltenham very much as I did at Exeter; and the Bishop of Exeter in remarks which those who advertise my lectures have made rather more public than I should myself have desired, spoke of that lecture in terms which assuredly encouraged me marvellously. This lecture, the local "at large" found most empty of all real information (meaning doubtless the sort of information children need) and "containing a grave offence against the religious feelings of the audience." Dr. Temple did not find anything irreverent in the suggestion that the angel seen by David and the elders of Israel with drawn sword over Jerusalem, who subsequently returned his sword into the sheath, "was only a comet." The idea was at any rate not brought forward for the special benefit of my audience at Cheltenham, but will be found fully dealt with in my article on Dangers from Comets ("Mysteries of Time and Space," p. 207). There is no doubt that the men of those old times found signs in natural phenomena. For them the sun, moon, and stars *were* "for signs." The "stars in their courses" fought for and against men. Is there irreverence in saying that the "bow" seen by Noah and his family, in the heavens, and by them regarded as the token of a covenant, was *only* a rainbow? The account in both cases correctly presents the feeling with which men in those days regarded all that they saw in the heavens. That the comet should be regarded as an angel of the Lord is no stranger than that a rainbow should be regarded as a token of God's promise. It would indeed be absurd for us to view either phenomenon in this way; but it was a natural and even beautiful thought in old times.

IT would be strange if comets, the most impressive and awe-inspiring of all the celestial phenomena, had been left entirely unnoticed by men so impressionable as clearly were those writers to whom we owe the older books of the scant but precious Hebrew literature which has reached our time. I take the true explanation to be that which I have suggested, that comets appeared to the children of Israel even more impressive than to other ancient nations, and that as they found in the rainbow a message of mercy from the Almighty, so in a comet they saw His message of wrath, with a sword which, as the comet moved, turned every way, or waved threateningly over Jerusalem. In later ages we know that men recognised in the slow retreat of a comet the sheathing of a mighty sword. What more natural than that the people of David's time should have thought that the angel of the Lord "put up his sword again into the sheath thereof." That these ideas were natural in those days, and even much later, is shown by what Josephus says of those who "having no understanding rightly to use their eyes" did not heed celestial messengers of wrath—"as for example that comet in the form of a sword which hung over Jerusalem for a whole year."

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

All Remittances, Cheques, and Post Office Orders should be made payable to MESSRS. WYMAN & SONS.

The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

A STRANGE COINCIDENCE.

[1237]—As you are just now open to correspondence upon the subject of coincidences and the like, you may not think the following too long for, or unworthy of, insertion in your columns:—

On Sunday, May 6, 1866, I was sitting in our drawing-room with my father, about 9.30 p.m., when my mother, who had been upstairs, came down hurriedly, and in great excitement stated that, whilst speaking to one of the children in bed, she had heard footsteps ascending the stairs; the door of the room she was in had been pushed open, that the same footsteps had gone up another flight of stairs and into a room overhead, where her eldest son, then absent in Australia, had formerly slept.

Father and I immediately took a light and went upstairs, and indeed all over the house, without finding anything to afford us the notion that any human being had caused the noise which had so agitated my mother.

On returning to the drawing-room we found mother in tears, and, in despite of our assurances, she remained impressed with the belief that it was a supernatural visit, and that she would never see her absent son again.

The circumstance passed from my mind, and in the July or August of that year (1866) we received a letter from my brother, stating that he should sail from Melbourne in the *General Grant*, and that (D.V.) we might expect to see him almost as soon as his letter reached us.

After anxiously watching the papers for some weeks afterwards, no tidings of the *General Grant* came to hand, and ultimately she was numbered amongst the "missing"; and although we still hoped against hope, nearly eighteen months had passed when one morning a paragraph appeared in the daily papers announcing that a telegram had been received to the effect that the *General Grant* had been wrecked on the Auckland Isles, and that a few of her survivors had subsisted there for a period of thirteen months. Later news brought a list of the survivors and details of the wreck, but my brother's name was not included in the list.

The details (I am quoting from memory, as I have not read them since 1868) stated that the vessel had been found to be out of her course (it seems, however, that the Auckland Isles had been wrongly charted), and before they were able to adopt any means to prevent it, she had been dragged by currents towards one of the islands and into a cave, in the recesses of which she was rapidly dashed to pieces, but not, however, until all the boats had been filled with passengers and despatched with a view of landing upon the islands. One of the boats, containing upwards of a hundred of the passengers, &c., was unhappily beaten against the rocks, and all on board drowned.

The survivors stated that as they rowed away from the mouth of the cave the captain and one or more men, who could not be accommodated in the available boats, were seen clinging to the rigging of the vessel, and that when some of them subsequently returned to the cave, all traces of the *General Grant* had disappeared.

According to the narrative it was in the evening of May 5 that they found themselves in the vicinity of the islands which proved so disastrous to the vessel and its occupants, but no particulars were given as to what hour the long-boat was lost, nor what time it was when the boat containing the survivors lost sight of the captain and his companions.

Now it will be seen from what I have stated that my brother

must have been lost *about* May 6, the date when the strange noises at home impressed my mother with the belief that she would never see her son again; but I have never been able to obtain any information which would enable me to make, what I have ever since looked upon as a coincidence, more complete. Perhaps this may meet the eye of one or more of the survivors, who might be able and disposed to furnish the necessary information, which would not fail to be of interest generally, and to myself in particular.

As far as I have been able to learn, 9.30 p.m. May 6 in London would be equivalent to 8.30 a.m. *May* 7 at the Auckland Isles, so that the only date given by the survivors which I have seen affords little or no evidence even as to the coincidence of the matter, as the evening of May 5 at the Auckland Islands—supposing the wreck occurred in the evening—would have been the morning of the same date here, or eighteen hours before the noise my mother heard.

It may be, however, that the actual loss of the vessel, or, at any rate, of the life of my brother, may not have happened until the hour coincident with 9.30 p.m. here of May 6, and I shall therefore be glad indeed to learn through your columns some positive information on the subject.

Personally, I do not believe in apparitions, nor in anything akin thereto; but coincidences such as you record from week to week must have happened to most of us, and obtuse indeed must the individual be who does not think that there is something supernatural sometimes even in coincidences. J. J. COLLINS.

VISION.

[1238]—The writer of letter 1174, April 4, is, I think, wrong in stating that visual impulses are caused by the "vibrations" of the optic nerve fibres. The presence of the blind spot, and the phenomenon of Parkinge's figures, prove that the optic nerve fibres are insensible to light. It is probably in the layer of rods and cones that the impulses originate, though how rays of light stimulate those bodies is not definitely known. There is no absolute proof that visual sensations become perfected into visual perceptions in the frontal lobes.

It is manifestly incorrect to speak of effects produced in the "optic ganglia" by an intrinsic stimulation, as "optic *nerve* vibrations." J. C.

THE MYSTERY OF GRAVITY.

[1239]—I perceive from your answer to my question, Vol. V., No. 127, p. 232, that my illustration of the difficulty of reconciling the law of gravitation with that of the conservation of energy was not the best I could have chosen; and, with your permission, I will again try to make my meaning plain, in the sincere hope that you, or some one else, will point out the fallacy, if there be one, in my argument.

I am travelling beyond the boundaries of civilisation, and have no books of reference with me to give an accepted formula of the second of these laws; which is, however, generally supposed to teach that energy is an entity, the amount of which in the universe can never become greater or less, but that there are various forms of it, among which are commonly enumerated heat, light, electricity, momentum and latent energy, such as that in fuel, all of which are convertible into one another in definite proportions, so that the amount of work which can be done by each of them under fixed conditions can be exactly measured; the energy in a pound weight of coal can, for instance, be converted into a measurable amount of heat, which, again, can raise a certain weight a definite height, and after this has been done all the energy in the coal has passed away.

In addition to these and other closely allied forms of energy there is a more mysterious one, known as the attraction of gravitation, which is at least in so far of the same nature that it can generate either directly or indirectly momentum, heat, &c., but of which it cannot be proved empirically, as it can of the other forms, that it becomes less in proportion as work has been done by it.

Thus, if the energy in falling water is traced backwards, the source of it will be found in the attraction of the earth. It has been hastily assumed that its source is the sun, whose rays are said, not by poets only, to draw up water into the sky. It is obvious, however, that though the sun's heat vapourises the water, and thus renders it lighter than the air, it is the gravitation of the earth which forces it upwards, like a cork is forced to the surface of water by the superior weight of the latter, and that after the vapour has gradually radiated into space, or otherwise lost the energy it had derived from the sun, it again condenses, and, becoming heavier than air, is drawn downwards by the gravitation of the earth; nor is there any connection or commensurability between the energy of falling water upon the earth and that energy of the sun which had previously vapourised it, and which had been absorbed by the vapour—according to Professor Tait, to the amount of one-horse-power for half-an-hour to every quarter of an inch of water, but all this energy had departed before the vapour was again condensed. The energy expended on the surface of the earth by falling water has been great beyond conception. We know the effects of a portion of it in continents carried down into oceans, and this vast molar motion was, it is presumed, converted gradually into molecular and dissipated into space; now it was all derived in the first instance from the attraction of the earth, but no one will venture to say this work was done at the expense of this attraction, and that the energy of it is being gradually used up and passing into other forms. You lately explained that gravitation is a mystery. I offer what seems to me a fresh proof of this, for, though the conservation of energy is a postulate of reason, neither observation nor experiment can bring this law into harmony with the phenomena of gravitation. J. C. MURRAY AYNSLEY.

AN UNSOLVED TRICYCLE PROBLEM.

[1240]—Simply our old friend the "Sucker." The tyre being round the weight on the *centre* of the track only is great enough to enable the tyre to draw up a ridge of dust after it; *mud* sticks to the whole of the bottom surface of the tyre, which we all know only too well. R. P. G.

CATS AND DOGS.

[1241]—I notice the last paragraph of the article, p. 243 of last week's KNOWLEDGE, taken from a paper by Mr. C. A. White. What he there states is doubtless generally correct, but I have a brindle terrier and a tabby cat which quite reversed what seems to be the usual state of things.

About a year ago I moved a short distance; the dog was many times afterwards found at and brought from the old house, but the cat never. The moving made no difference to him. Each is an affectionate animal to us all. E. B. WILLIAMS.

SCHMIDT'S LUNAR MAP.

[1242]—In reply to "G. Williamson," permit me to say that Mr. Wesley, Essex-street, Strand, London, could very likely supply Schmidt's Great Map of the Moon. I know it was in his catalogue the other day. Mr. Wesley has served me well on many occasions. "Let Knowledge grow from more to more." ARTHUR MEE.

South Wales Press, Llanelly.

EARTHQUAKES FROM THE DISTURBANCE OF THE SUBTERRANEAN WATER DISTRIBUTION.

[1243]—The recent earthquake has suggested to me the possibility of earth movements from the disturbance of the supply of water to the subterranean reservoirs by reduction, and also by hydraulic pressure; in the first case by producing a vacuity under a large district, causing a subsidence of the land; and in the second by a lofty head of water, of small diameter, acting upon a large area of pent-up, confined fluid without other outlet, causing an elevation of the strata above it. It has been reported that at Colchester, previous to the earthquake, there was a deficiency in the supply to the waterworks, and that alterations in the engine-pumps were contemplated, and that after the earthquake the water rose in the wells 75 ft., so that the proposed alterations in the pumping-gear were abandoned. This extraordinary supply may have been caused by a subsidence of the land, pressing upon the water in the internal reservoirs, and thus forcing it into all the outlets, into the supply wells. If this were really the case, it is probable that the extraordinary supply to the waterworks will be of short duration—nay, that in a short time it may altogether cease.

W. CAVE THOMAS.

CAN THE SEVERED HEAD THINK? FALSE PERSPECTIVE, &c.

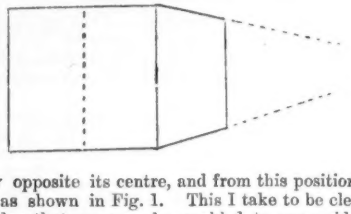
[1244]—Thought seems to act with almost infinite rapidity. For example, an apparently long and circumstantial dream is often suggested by some sound that appears to be actually connected with an incident that comes in at its conclusion and causes us to wake with an unpleasant start. It is reasonable, therefore, to suppose that there is ample time for much intensely horrible thought during the instant the guillotine's sharp knife is passing through the hapless culprit's neck. Cerebration may perhaps continue as long as there remains any blood in the brain; if so, what ghastly and phantastic processions may pass before one of Mr. Binn's slowly-strangled victims!

Dr. Lamprey, then of the 67th Regiment, in his lecture delivered at the United Service Institution some years ago (the subject was

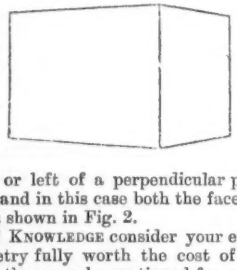
the Economy of the Chinese Army) relates the following curious anecdote:—

"I was passing through the narrow main street (of Taitsan) when my attention was drawn by a crowd of people looking at what proved to be the head of a Chinese soldier who had just suffered decapitation. . . . While looking at this head I was much struck by observing the quality of saliva that continued to flow from the mouth, and on examining the appearance of the wound, a very jagged one, indicating that it was not done by one clean cut, I observed that there was a remarkable spasmodic action of the incised muscles of the back of the pharynx and tongue, and continuing to notice this for a little time, I found that the action of the contraction and relaxation occurred at irregular intervals, and that all the muscles appeared to act together. That this was or was not an evidence of consciousness or thought passing in the mind of the individual, may be a difficult problem to solve; but, be this as it may, I could not help recording the exclamation of one of our soldiers—an Irishman, of course—who was standing by, and observed me watching the muscular movements which he also noticed. 'Arrah sure! sir,' said he, 'I think he is striving to spake.'" After a lapse of ten minutes or so, the doctor remarked that the muscular movements continued to be nearly as active as at first. Here, certainly, is food for most curious speculation.

In many elementary books on perspective, I find the followin obvious mistake, which, I think, few teachers trouble themselves correct. We are supposed to view the front face of a cube from



point exactly opposite its centre, and from this position to see one of its sides, as shown in Fig. 1. This I take to be clearly impossible. In order that we may be enabled to see a side, we must



stand to the right or left of a perpendicular passing through the centre of the face, and in this case both the face and the side would appear to retire, as shown in Fig. 2.

Many readers of KNOWLEDGE consider your excellent Lessons on Co-ordinate Geometry fully worth the cost of the entire journal, and I for one trust they may be continued for a long time to come.

R. JONES.

THUMB WEAKNESS.

[1245]—Is it too much on my part to ask if any of your correspondents can explain how it is that the power of using the thumb for holding the pen in writing should have been (practically) absolutely taken away, whilst the power of writing solely by holding the pen in the first and second fingers has developed? There are in this town two cases I know of (myself and another.)

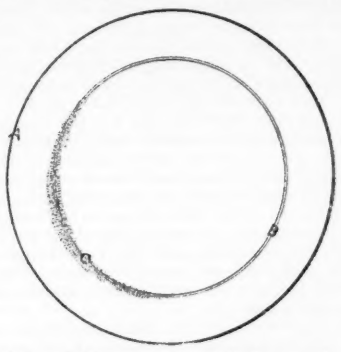
The ability to use the thumb continues for all ordinary purposes except that of holding small, slender bodies so as to move them at will between the thumb and fore fingers.

Can they suggest any remedy for restoring the use of the thumb, for it seems highly probable that continuing to write with the thumb packed in the palm must weaken it?

"PHONO."

DUST.

[1246]—With reference to Professor Langley's article on "Our Earth's Dust Envelope," I venture to add two notes as illustration. 1. The singular, and perhaps oft-noted, appearance of dust within binoculars ont here. If you leave a pair, after cleaning, on your table for a fortnight, untouched, as surely will you find a layer of dust on the inner and upper face of the object-glass. How did it get there? Of course, the ready reply is, it is merely the dust, already in the interior, deposited on the object-glass. *That it must be*, but the question is, how did it get there, and why is it not deposited equably on the inner surface of the object-glass, but invariably in a circle corresponding in size to the draw-tube holding the eye-pieces? This diagram will illustrate my meaning. A is the object-glass, B the proportionate size of the draw-tube, and C the circle of dust on the object-glass. Often and often have I most



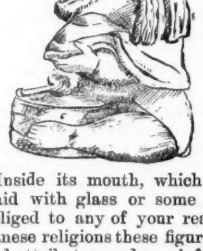
carefully dusted and blown out the interiors, and then rapidly screwed on the object-glasses, but the result is the same. If such comparatively small interiors cause sensibly and quickly-deposited dust, what must be the deposition of the earth at large?

2. Years ago, when returning from India, and voyaging to the Cape as a boy, the sight of a particular part of the voyage was to see the sails reddened by sand blown from, the Captain said, "the Desert of Sahara!" This sand was sent to Ehrenberg, and he declared it to be made up entirely of fossil organisms found only in South America. Fancy the gigantic proportions of that whirl, which, licking up the South American infusorial deposit, bore it aloft eastwards, dropping it in Africa and on our passing ship, miles from its coast, in its westward sweep!

Morai, Bengal, 1884. R. F. H.

JAPANESE FIGURES.

[1247]—I have two Japanese carvings. One is apparently a woman with long hair, and the lower part of the body is in the form of a fish or snake, coiled round an object like a thimble, which I think is a bell. In the right hand is a hammer. The other figure here represented seems to be a dog-headed dwarf, holding between



its feet a drum. Inside its mouth, which is open, is a human face, with eyes inlaid with glass or some shining substance. I should be greatly obliged to any of your readers who would state to which of the Japanese religions these figures belong, their names (*i.e.*, the figures') and attributes, and any information about them.

E. C. R.

SCIENTIFIC MORALITY.

[1248]—Your correspondent "T. Common," in the letter referred to above, says:—"For those who have independent means, erroneous theories as to duty are not so serious." If the word duty is here intended to mean, as it would imply, the *whole* duty of those who have independent means, this is surely a great mistake, and is inculcating the principle that in ethics there is one law for the rich and another for the poor. It is, indeed, a question whether the disregard of duty on the part of the rich is not the cause of all the Socialistic agitation that is disturbing society at the present moment.

With the spread of education, men who beforetimes were mere machines are learning to think for themselves, and, by the aid of a cheap and free press, to compare facts, and reason upon them. While the lower classes were steeped in ignorance, a deficiency in sense of duty among those above them was likely to pass unnoticed; but all that is changed, and if the leaders of society would retain their pre-eminence they must not only possess theories of duty at once exalted and free from error, but they must manifest them by their lives and conduct, and so exemplify that high standard of morals, the universal adoption of which is a people's surest road to happiness and prosperity.

It appears to me that we are approaching a critical stage in our national life; a point from which a new departure must be made. What our future course may be will depend upon the standard of morals that is allowed to influence us now. If high, and embracing the rights of all, the new departure may be made peaceably, and will lead us to contentment and greater prosperity; if low and cramped by selfishness, it may be disastrous. But since all peaceable reforms must emanate from the legislating class (the wealthy), it is of all times the moment when the possession by this class of erroneous ideas on the question of duty would be most serious.

A. McD.

[It appears to me that Mr. T. Common and Mr. A. McD. are very much at one. Due consideration for the rights of others as well as self seems to be the rule each would lay down.—R. P.]

THE DIASCOPE.

[1249]—Several years since I projected the construction of a diascope—of an instrument for cross vision, *i.e.*, the right eye seeing the objects on the left, and the left eye the objects on the right. My first experiments were made with two paper tubes that could be crossed, and with these I found that the objects seen with the right eye *appeared* to be seen with the left, and *vice versâ*. More recently I have tried two stereoscopic photos, and these appear to combine equally well when the photo on the right is seen by the left eye, and that on the left by the right. On this point, however, I should like to have confirmation. I find, too, by means of the diascope that the field of each eye appears to be of a different tint.

W. CAVE THOMAS.

A PHENOMENAL VOICE.

[1250]—Could any of your musical or physiological correspondents kindly give me a proof of the assertion quoted from Dr. Carpenter in an article by Professor Jeffrey Bell in "Science for All" (Vol. V. p. 45)—"that the celebrated Madame Mara was able to sound one hundred different intervals between each tone. The compass of her voice being at least three octaves, or twenty-one tones, the total number of intervals was 2,100, all comprised within an extreme variation of one-eighth of an inch; so that it might be said that she was able to determine the contractions of her vocal muscles to nearly the $\frac{1}{17000}$th of an inch."

I have a musical friend who altogether denies its possibility, and though I myself am perfectly convinced of its validity, I am unable to remove his doubts.

E. R. COX.

A SPORTING PROBLEM.

[1251]—A sporting paper recently offered a sum of money as a prize to the individual who succeeded in placing the first three horses, as placed by the judge, in each of two races. In the first race there were 81 entries; and the second, 63. Would you kindly calculate, and answer in an early number, the odds against one individual doing this, and the number of papers he would have to purchase to make his winning the prize an absolute certainty?

NED W. WITHERS.

[The number of possible first threes, in definite order, among 81 horses, is $81 \times 80 \times 79$ or 511,920. The number of possible first threes, in definite order, among 63 horses, is $63 \times 62 \times 61$ or 238,266. The total number therefore of possible events is obtained by multiplying together 511,920 and 238,266. Roughly, about 123,000,000,000 copies of the paper would have to be bought to insure winning the prize, which ought to be a rather large one,—say about £500,000,000 if the paper is a penny one.—R. P.]

LETTERS RECEIVED.

T. K. B. I fear that no change in the aperture of eye-piece would be of any use. The eye-glass is made just large enough for all the emergent beams to pass out, and you would find the same effect of looking through a small hole, even though the eye-glass were an inch in diameter. The only way in which, in your case, high powers can be used, is by increasing the size of object-glass. A refracting telescope, having a large O.-G. and short focal length, would suit you. A reflecting telescope would be better still. But whatever telescope you use, you will not be able to use the highest power it will bear with ordinary eye-sight.—JAS. WHITELAW. The earth enters Libra, not Aries, in spring. It is the *sun*, viewed from the earth, which enters Aries at the vernal equinox.—J. BINDON CARTER. I sincerely hope, in the interests of the Martial snail, that the Martial cabbages *would* be on the enlarged scale you mention. But I have no direct information to offer. Very likely there are no creatures on Mars akin to men, elephants, or snails.—J. MURRAY. I am sorry, but hasten to repair the omission by noting that the P.D. system *does* seem to lead you entirely astray.—M. X. Y. It seems to me that in whatever degree the roof impeded the rush of air, in deflecting it, in the same degree would the chimney be protected.—F. H. WOOD. Should have been delighted to examine your geometric ruler; but shall not be at home on a Monday, Wednesday, or Friday (see Lecture List) for weeks.—W. F. CURTIS. The sun and moon cannot be magnified in the way you suggest; moreover, they are not so magnified. They do not look larger near the horizon. We only fancy they do. A halfpenny at the end of a nine-foot rod (square to its length, the eye being at the other end) will just hide the mid-day sun: well you will find that it will also hide the setting sun. The sun and moon both *look* almost exactly as large as a one-inch globe nine feet away, whether they be high up or low down. The moon looks a little *smaller* on the horizon, being then a little farther away than when high up.—SIMPLEX. There is no fallacy whatever about your plan for trisecting an angle. Roll the arc that way, and you can trisect it, and the angle. Roll the whole circumference, and you can rectify, and in effect square the circle. But I have not yet heard of any postulate in "the geometry of the line and circle" running thus:—Let it be granted that the arc of a circle may be rolled along a straight line, so that the points of contact with given points on the line may be marked off on the circumference of the circle.—P. M. C. K. Thanks for account of two large meteors on May 5, at 7. I would insert, but the real paths of the bodies in the air could not be ascertained from positions so "general."—T. H. CHRISTY. Telephone wire sent to electrician. —W. W. SAWTELL. The planchette story is curious; but probably not more than a coincidence.—H. A. VINCENT. Which *is* the great sympathetic nerve? Your theory does not correspond with the history of *all* great poets: and I rather doubt your statement that the born poet has "a peculiar longing and desire for spirits." If adopted that theory would encourage many who are not born poets to imagine such a longing. As a born poet (no doubt) remarked, "A man carn't make hisself a poat, no mor'n a sheep can make itself a goat," but a man *can* make himself a spirit-swiller.—GEO. ELLIS.—You will find me giving the same explanation in *Nature* somewhere about the year 1870. But it never occurred to me that the explanation was a new one. Naturally I agreed with your view, and inserted your letter (KNOWLEDGE, Oct., 1882) as expressing well the theory. Why *should* I "be vexed with you"?—PROTEA. 1. Professor Ledger's Gresham Lectures are thoroughly trustworthy. 2. "Romance of Astronomy" rather weak. 3. A red star was suspected by Trouvelot during last eclipse; but it was certainly not Vulcan (probably for the excellent reason that there is no Vulcan).—JOHN HAMPDEN. We have had enough of the Zetetic astronomy, and cannot allow our readers to be further troubled with such utter rubbish. Who is there who can possibly profit by anything on the subject? Can you imagine that it would be of the least moment if the ten or a dozen, or it may be twenty, persons who have been deceived by Parallax's pretended experiments could be convinced of their folly? The subject has served its purpose in showing what foolish folk may manage to remain at large. The recent letters have brought out—what might have been expected—the fact that the folly of these persons is not limited to one particular subject, but shows itself in whatever they say or do, and is in fact practically unlimited. If it has not made clear to *every* reader of KNOWLEDGE the reason why Parallax started the Zetetic absurdity, there must be one or two foolish readers still remaining,—and we cannot alter our ways on their account. Seek some other paper as a channel for Zetetic nonsense: we will have no more of it.

Our Mathematical Column.

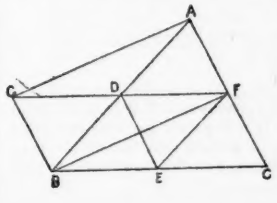
NOTES ON EUCLID'S FIRST BOOK.

BY RICHARD A. PROCTOR.

(*Continued from page* 318.)

WE shall now proceed to some problems on the subject of the First Book, which are of great utility and importance.

PROP. XX.—*If the three sides* A B, B C, C A *of the triangle* A B C *be bisected in the points* D, E, *and* F, *the three lines* D E, E F, *and* F D *are respectively parallel to the sides* C A, A B, *and* B C *of the triangle*, A B C, *and equal to the halves of these lines, respectively.*

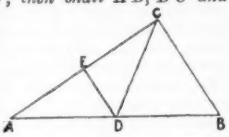


For, produce F D to G making G D equal to D F and join B G, A G. Then by Prop. XVIII. *conv.*, since A B, G F, are bisected in D, A G B F is a parallelogram. Therefore B G is equal and parallel to A F;

that is, to F C. Therefore (Euc. I. 33) G F is equal and parallel to B C. But G F is double of D F (*const.*) and B C of E C (*hyp.*); therefore D F is equal to E C or B E. And in like manner it may be shown that D E is parallel to A C and equal to A F or F C; and that E F is parallel to A B and equal to A D or D B.

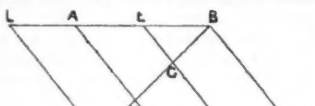
COR.—The four triangles A D F, E F D, B D E, and F E C are equal in all respects (Euc. I. 8 and 4), and equiangular to the triangle A B C.

PROP. XXI.—*Let* A C B *be a right-angled triangle,* C *being the right angle, and let* A B *be bisected in* D; *then shall* A D, D C *and* D B *be all equal.*



Bisect A C in E and join D E; then D E is parallel to B C (Prop. XX.). Therefore the angle A E D is equal to the interior A C B (Euc. I., 2); that is A E D is a right angle. Thus the line D E is at right angles to and also bisects the side A C of the triangle A D C; therefore (Prop. XIII.) A D is equal to D C. Similarly D B is equal to D C.

PROP. XXII.—*If the two equal and parallel straight lines* A B, D C *be bisected in the points* E *and* F, *then* C E *and* A F *trisect the line* D B *in the points* G *and* H.



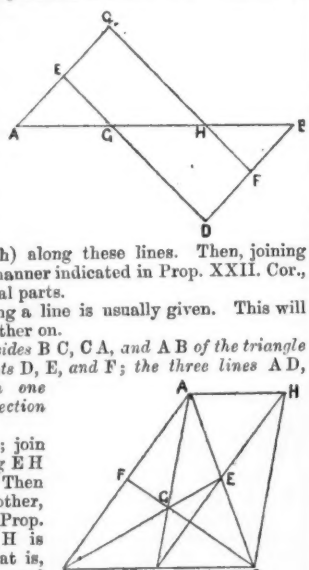
Produce B A to L making A L equal to A E or E B; and produce D C to K making C K equal to D F or F C. Join L D and B K. Then since the lines L A, A E, and E B, are equal to each other and also to the three lines D F, F C, and C K; therefore (Euc. I., 33), the lines L D, A F, E C, and B K are parallels. But L B is trisected in A and E where it meets the parallels. Therefore B D is trisected in G and H. (Prop. XVII.).

COR.—If A B, C D were divided into any number n of equal parts, and lines drawn from C to the division-point nearest B, from the division-point nearest C to the second division-point from B, from the second division-point from C to the third division-point from B, and so on, these lines would divide the diagonal B D into $(n + 1)$ equal parts.

The proof of the corollary would be similar to that of the proposition, C K and A L being taken equal to any one of the n equal parts of B A and C D.

PROP. XXIII.—*To trisect a given straight line.*

Let A B be the given straight line. From A and B draw, in opposite directions, the equal parallels A C and B D. Bisect A C in E and B D in F. Join D E, and C F; intersecting A B in G and H. Then A B is trisected in G and H. (Prop. XXII.)



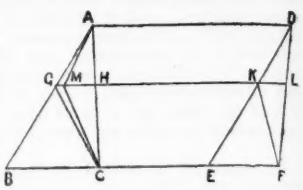
COR.—In like manner we can divide a straight line into any number, n, of equal parts. For we have only to draw two unlimited parallels in opposite directions from the points A and B, and to take off from A and B $(n-1)$ equal divisions (of any length) along these lines. Then, joining the points of division in the manner indicated in Prop. XXII. Cor., A B will be divided into n equal parts.

Another method of trisecting a line is usually given. This will be presented as a problem farther on.

PROP. XXIV.—*If the three sides* B C, C A, *and* A B *of the triangle* A B C *be bisected in the points* D, E, *and* F; *the three lines* A D, B E, *and* C F, *pass through one point, which is a point of trisection of each of the three lines.*

Let B E intersect A D in G; join D E and produce to H, making E H equal to E D. Join A H, H C. Then since A C and D H bisect each other, A H C D is a parallelogram (Prop. XVIII. *conv.*). Therefore A H is equal and parallel to D C; that is, to B D (*hyp.*). Hence H D is equal and parallel to A B, Euc. I., 33, and therefore, since D E is equal to E H, D G is a third part of A D (Prop. XXII.). Similarly it may be shown that C F cuts off from A D a third part, towards D. That is C F passes through the point G. And as G D has been shown to be a third part of A D, so may G E be shown to be a third part of B E, and F G to be a third part of F C.

PROP. XXV.—*If the triangles* A B C, D E F *be on the equal bases* B C, E F, *and between the same parallels* A D *and* B F, *and* G H K L *be drawn parallel to* B F, *meeting* A B, A C, D E, *and* D F *in the points* G, H, K, *and* L *respectively,* G H *shall be equal to* K L.



For if not one of these lines must be greater than the other. Let G H be the greater, and from H G cut off H M equal to K L. Join G C, K F, A M, and M C.

Then, since M H is equal to K L, the triangles A M H and D K L are equal (Euc. I. 38), and so are the triangles M H C and K F L. Therefore the triangle A M C is equal to the triangle D K F. But the triangle B G C is equal to the triangle K E F (Euc. I. 38). Therefore the triangles G B C, A M C are together equal to the triangle D E F; that is, to the triangle A B C. But this is absurd. Therefore G H and K L are not unequal. Therefore they are equal.

(*To be continued.*)

EASY RIDERS ON EUCLID'S FIRST BOOK.

WITH SUGGESTIONS.

PROP. 26.

71. A E B, C E D, are two straight lines intersecting in C; A E is taken equal to E B and lines A D, B C are drawn in such a way that the angles E A D, E B C are equal. Show that E C is equal to E D.

72. If from any point in a line bisecting a given angle perpendiculars be drawn on the lines containing the angle, these perpendiculars shall be equal, and shall cut off equal parts from those lines.

73. In a given straight line find a point such that the perpendiculars from it on two given straight lines shall be equal.

74. Through a given point draw a straight line so as to cut off equal parts from two straight lines which meet in a point.

75. If the straight line which bisects the vertical angle of a triangle is perpendicular to the base the triangle is isosceles.

76. Through a given point draw a straight line such that the perpendiculars on it from two given points may be on opposite sides of it and equal to one another.

PROPS. 27 and 28.

77. Two straight lines A E B, C E D bisect each other in E; show that A C is parallel to B D.

PROP. 29.

78. From the centres A and B of two circles parallel radii A P; B Q are drawn; P Q meets the circumferences again at P and S show that A R is parallel to B S.

79. If a straight line be drawn parallel to one of the sides of an equilateral triangle, it will form with the other sides, produced if necessary, another equilateral triangle.

80. If a straight line be drawn parallel to one of the sides of a triangle, it will form with the other sides, produced if necessary, a triangle equiangular to the first.

81. Two straight lines, A E B, C E D intersect in E; two other straight lines A F and C G are parallel respectively to C D and A B; show that the angle A is equal to the angle C.

82. The point P lies between two parallel lines. Show that if any straight line through P terminated by the parallels is bisected in P, every straight line so drawn will be bisected in P.

83. The intersecting straight lines A E B, C E D, terminated by parallel lines A C, and B D, bisect each other in E; show that A C is equal to B D.

84. The line drawn through the vertex parallel to the base of an isosceles triangle is perpendicular to the line bisecting the vertical angle.

85. If the line bisecting the exterior angle of a triangle be parallel to the opposite side the triangle is isosceles.

86. If from any point in the bisector of a given angle lines be drawn parallel to and terminated by the lines containing the given angle, the lines thus drawn shall be equal and shall cut off equal parts from the others.

87. A B C is a triangle right angled at B, and D is the middle point of A C. Show that if the line E B F is parallel to A C, then the angle E B A is equal to the angle A B D, and the angle D B C to the angle C B F.

(*To be continued.*)

Our Chess Column.

BY MEPHISTO.

THE following two games were played between Dr. Zukertort and Mr. Charles A. Maurian, at the rooms of the new Orleans Chess, Checkers, and Whist Club, April 16, 1884. — *Times Democrat*).

GIUOCO PIANO.

White. Mr. C. A. Maurian.	Black. Dr. Zukertort.	White. Mr. C. A. Maurian.	Black. Dr. Zukertort.
1. P to K4	P to K4	21. Q to R5	Castles
2. Kt to KB3	Kt to QB3	22. P takes P (*d*)	P takes P
3. B to B4	Kt to B3	23. Kt to B3	B to K3
4. P to Q3	B to B4	24. R takes R(ch)	Q takes R
5. B to K3	B to Kt3	25. Kt takes P	P to B6 (*e*)
6. QKt to Q2	P to Q3	26. B takes B(ch)	R takes B
7. Kt to B sq	Kt to K2	27. P takes P	Q to Q7
8. Kt to Kt3	P to KR3	28. Kt to Kt4 (*f*)	Q takes KtP
9. Q to Q2	P to B3	29. Q takes BP	Q takes RP
10. P to B3	P to Kt4	30. K to Kt2	Q to Kt6 (*g*)
11. P to Q4	Q to B2	31. Kt to B6	P to QR4
12. R to Q sq	Kt to Kt5	32. Kt to Q5	P takes Kt (*h*)
13. P to KR3	Kt takes B	33. Q takes R(ch)	K to Kt sq
14. Q takes Kt (*a*)	Kt to Kt3	34. Q takes QP	Q to Kt7
15. Kt to R5	Kt to B5	35. R to KB sq	P to R5
16. Kt takes Kt	KtP takes Kt	36. Q to Q6 (ch)	K to R2
17. Q to Q2	R to Kt sq (*b*)	37. Q to QKt4	Q to R7 (*i*)
18. K to B sq	R to Kt3	38. P to QB4	B to Q5
19. Kt to R4	R to B3 (*c*)	39. Q to R5 (ch)	
20. Q to K2	B to Q2		

And White wins.

NOTES.

(*a*) If 14. P takes Kt, Black replies with 14. * * P takes P, and white cannot take without losing a piece by 15. * * P to Q4.

(*b*) 17. * * B to Q2, preparing for immediate castling, would be better, and leave black with a slight superiority.

(*c*) If 19. * * R to Kt2, or to Kt sq, White would probably gain an advantage by 20. P takes P, followed by Q to Q6.

(*d*) Had White captured the BP, he would have lost his QP in return, as Black would have replied with 22. * * P to QB4, threatening to win a piece by B to QKt4.

(*e*) Unsound. 25. * * B takes B; 26. Kt takes B, Q to Q6 (ch); 27. Q to K2, &c., would draw.

(*f*) The only move. If 28. R to R2, then 28. * * B to B2, &c.

(*g*) 30. * * P to KR4 would have extricated the Rook, and is, therefore, better.

(*h*) Forced. If 32. * * R to Q3; 33. Kt to K7 (ch), winning the Queen.

(*i*) 37. * * Q takes Q appears better, but White could still win, we think, as follows:—38. P takes Q, B to Q5; 39. R to Q sq, B to Kt7; 40. R to Q5, P to Kt3; 41. P to K5, P to R6; 42. P to K6, P to R7; 43. P to K7, P queens; 44. P to K8, queens, and wins.

(The second game played on the same occasion.)

EVANS' GAMBIT (compromised).

White. Dr. Zukertort.	Black. Mr. C. A. Maurian.	White. Dr. Zukertort.	Black. Mr. C. A. Maurian.
1. P to K4	P to K4	13. B to Q3	Q to R4
2. Kt to KB3	Kt to QB3	14. Kt to K4 (*b*)	R to K sq
3. B to B4	B to B4	15. Kt to Kt3	Q to Kt 5
4. P to QKt4	B takes KtP	16. KR to K sq	P to Q4 (*c*)
5. P to B3	B to R4	17. P tk P *en pass.*	P takes P
6. P to Q4	P takes P	18. QB takes P	B to K3
7. Castles	P takes P	19. Q to Kt sq	B to Q4 (*d*)
8. Q to Kt3	Q to B3	20. B takes P(ch)	K to R sq
9. P to K5	Q to Kt3	21. B to K4	Q to Q2 (*e*)
10. Kt takes P	KKt to K2	22. B takes B	Kt takes B
11. B to R3	Castles	23. R takes Kt	R takes R (h)
12. QR to Q sq	B to Kt3 (*a*)	24. Kt takes R	

And White wins.

NOTES.

(*a*) 12. * * P to QKt4 is acknowledged to be best. The text move prevents the development of the Queen's Bishop, and permits the adverse King's Rook to occupy the all important King's file.

(*b*) 14. KR to K sq would be stronger still.

(*c*) Black's position is indeed unenviable, and this move is certainly not calculated to benefit it.

(*d*) It was necessary to prevent R to K4 at all hazards.

(*e*) Which loses a piece; but Black's game was past redemption, as the entry of the hostile Rooks into his game must prove fatal.

ENDING p. 299.

1. Kt × P (ch)	1. Kt × Kt
2. B to R5	2. Kt to Kt2
3. B × P	3. Kt to Q sq.
4. B to K8 (ch)	4. K to B2.
5. P to Kt6, and wins.*	

White's second move forms the key-move to the position. But it cannot be played without 1. Kt × P preceding it; the object of this move being to prevent the Black Knight from coming to the assistance of his Pawns. If White at once plays 1. B to R5, then Black would play Kt to Q sq., and White would lose if he took the Pawn, *i.e.*, 2. B × P, P × B. 3. P to R7, Kt to B2. Of course if Black moves his K in reply to Kt × P (ch), then White takes the Kt and plays B to R5. White could not play 4. B × P, to which Black would reply with Kt to B2, and however White may play Black must gain a P, and by giving up his Kt for the other P draw the game.

After 1. Kt × P (ch), Kt × Kt. 2. B to R5, B to Kt3, White wins by 3. B × P, B to Q sq. 4. B × P, P to K3. 5. P to Kt6, &c.

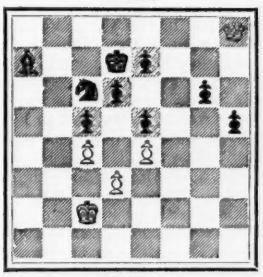
This ending is a good example of the danger attending Pawns when not on the same colour of square as the Bishop.

Three of our correspondents (Clarence, W. H. L. M., and A. H. E.) have pointed out to us one variation in which, although White is successful in his design, yet he will not be able to force a win—*i.e.*:—

1. Kt takes P (ch)	1. Kt takes Kt
2. B to R5	2. P takes B
3. P to Kt6	3. P takes P
4. P to R7	4. K to Q2
5. P to R8 (Q)	5. Kt to QB3

Now, we must confess that we took it for granted—too readily, perhaps—that with a Queen White could win. On examining the position, we have, however, come to the conclusion that a win cannot be demonstrated for White. We do this in spite of the fact that White has yet some winning chances left if, after capturing the two passed Pawns, he can work his King round the Queen's or King's side so as to press Black to abandon the defence of his Pawns. If feasible, this, at best, is a very tedious process, and beyond the range of that practical analysis within which such examples ought to be confined.

BLACK.



WHITE.

Our award of the prize lay between the three above-named competitors, and, after examination of their respective solutions, we have decided to make the award in favour of Brockelbank. We acknowledge, among others, a specially neat solution from H. Doyle.

SOLUTIONS.

PROBLEM 117, by H. W. SHERRARD.

1. B to Q6	P × B (ch)	or	P to K3
2. K to Q5	any	2. R to Kt3 (ch)	K to K5
3. R to Kt3	mate	3. B to B2	mate

PROBLEM 118, by F. J. LEE.

1. R to Q8	1. K to Q6
2. Kt to B5	Mate

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Correct solutions received from W. Hamahan, Arthur S. Rutter, Clement Fawcett, H. T. Hester, S. Osborne, Stettin.

An opponent wanted for correspondence game.

* An instructive end game.—R. P.

Our Whist Column.

By Five of Clubs.

WE have been asked by several readers of KNOWLEDGE to quote our synopsis of the various leads, in such a form that they can be readily studied at a glance and easily remembered. We would invite those who have tried to retain in their recollection the multitudinous leads given in the books heretofore published, to note how simple the Whist leads are when viewed as we have presented them. We venture to say—indeed, we *know*, having tested the matter—that a more perfect knowledge of the leads at Whist can be gained in a week by considering when to lead Ace, King, Queen, and so forth, than in two months at least by the usua method of considering what card to lead from each of the numerous combinations which the cards may present. Moreover it is found in practice that a learner who has followed our method at once picks up the habit of interpreting the leads of others, whereas one who followed the other method is often a long time in passing from a knowledge of what he should lead to the ready recognition (instant recognition, it should be, after a little practice) of the meaning of any given lead.

Synopsis of the Leads in Plain Suits.

Lead Ace, from Ace, with four or more others, not including King; from Ace, Queen, Knave, with or without others; from Ace, two others (not including King), if you have reason to believe that your partner has strength in the suit; and from Ace one other, whatever this other may be. The last two cases are, of course, forced leads.

After leading Ace, from Ace four or more, follow* with lowest, (unless you adopt Drayson's plan of playing lowest but one if there are more than four others). After leading Ace from Ace, Queen, Knave, follow with Queen if you have not more than one small one of the suit, otherwise follow with Knave. When you lead Ace from Ace two others (forced lead, follow with highest. Lead Ace from Ace, King, and others, when you have trumped another suit, lest your partner should trump your King, to establish a cross ruff.

Lead King, from Ace, King, and others; from King, Queen, and others (unless these others, being more than two, include the Knave); from King two others (forced lead), if you have reason to believe that your partner has strength in the suit; and from King one other (forced lead), whatever that other may be.

After leading King from Ace, King, and others, follow with Ace, unless you hold Knave, in which case you may sometimes—if the state of the score seems to render it advisable—change suit, that you may be led up to and finesse the Knave. After leading King from King, Queen, and others, if King makes, follow with small one, unless you hold Knave also, when follow with Queen (not with small one, because Ace may have been held up). When you lead King from King two others (forced lead) follow with highest.

Lead Queen from Queen, Knave, Ten, with or without others; from Queen, Knave, and one small one (forced lead); from Queen two others, not including Knave (forced lead), if you have reason to believe that your partner has strength in the suit; and from Queen one other (forced lead) whatever that other may be.

After leading Queen from Queen, Knave, ten, follow with Knave, unless you have five or more, when follow with lowest of the Queen, Knave, Ten sequence. After forced lead from Queen two others, if Queen makes, follow with highest.

Lead Knave from King, Queen, Knave, and not less than two others (not including ten); from Knave, ten, nine, with or without others; from Knave and two others (forced lead), and from Knave one other (forced lead).

After leading Knave from King, Queen, Knave, &c., follow with King if you have two small one, with Queen if you have more. After leading Knave from Knave, ten, nine, lead ten if there is only one card below the nine, the nine if there are more. After leading Knave from Knave two others, whatever they may be, follow with highest.

Lead ten from King, Queen, Knave, ten, with or without others; from King, Knave, ten, with or without others; from ten two others, or ten one other (forced leads). After leading ten from King, Queen, Knave, ten, follow with King if you have no small cards, otherwise with Knave. After ten from King, Knave, ten, play a small one. After forced lead of ten play your highest.

Lead nine from King, Knave, ten, nine; and in case of forced lead, from nine two others.

Lead a small card from all suits not considered in the above synopsis. Lead the lowest from four cards, the lowest but one from five or more (the lowest but two from six or more, if you care to adopt Drayson's rule); the highest from three or two small cards.

Note that it can scarcely ever happen that playing the lowest but one or two for the purpose of indicating length, can be mistaken by your partner for a forced lead from two or three small cards, or *vice versâ*.

We have already considered concisely, yet fully, the distinction between trump leads and leads from plain suits (see No. 12).

Observe that, short as the above synopsis seems, considering the multiplicity of Whist leads as usually presented, it would be very much shorter if it dealt only with original leads. For these one may say that all the beginner need learn is summed up in the following:—

Lead Ace from Ace and four others, following with small one; and from Ace, Queen, Knave, with or without others, following with Queen, if you have not more than one small one, otherwise with Knave. Lead King from Ace, King and others following with Ace; and from King, Queen and others, following with small one. Lead Queen from Queen, Knave, ten, following with Knave, unless you have five or more, when play lowest of head sequence. Lead Knave from King, Queen, Knave, and two or more, from Knave, ten, nine, with or without small ones. Lead ten from King, Queen, Knave, ten, and from King, Knave, ten, with or without others. Lead nine from King, Knave, ten, nine. In other cases lead a low one, the lowest if you have only four cards, the lowest but one if you have more.

Let the learner combine with this the general rule, that if he is obliged to lead from a weak suit, he always plays the best card of it, unless he has either Ace, King, or Queen, with two small ones. He now knows nearly all that he need know about leading from plain suits. All that he need at first notice about leading from trumps, is, that he can more safely play a waiting game in that suit, as his good cards in it cannot be lost by trumping; also that he must consider the trump card. The play in trumps is also apt to be modified by considerations depending on the state of the score, the position of the cards in other hands, and so forth.

* When we thus speak of second round, we do not wish the reader to forget that the first round may show it to be unadvisable to continue the suit; it may seem better to leave your own suit and ead your partner's, or to lead trumps, &c.

PEMBRIDGE.—We should be much obliged if you would send us some of your experiences of stupidity (or malignity?) We have still the third of your games in the *Westminster Papers* to quote.

Contents of No. 132.

	PAGE
The Common Newt. By Grant Allen	321
How to Get Strong	322
The Universe of Suns. By R. A. Proctor	323
The Patent Act of 1883. By Polyglot	324
Coincidences and Superstitions. By R. A. Proctor	326
Wireworms and Skipjacks. By E. A. Butler. (*Illus.*)	327
Vestiges of Creation	329
Pleasant Hours with the Microscope. By H. J. Slack, F.G.S. (*Illus.*)	330
Our Night Sign. (*Illus.*)	331
Odd Coincidences	332
Editorial Gossip	332
The Discovery of Pre-Historic Remains in Lincolnshire	333
The Face of the Sky. By F.R.A.S.	333
Correspondence	334
Our Mathematical Column	338
Our Chess Column	339
Our Whist Column	340

TERMS OF SUBSCRIPTION.

The terms of Annual Subscription to the weekly numbers of KNOWLEDGE are as follows:—

	s.	d.
To any address in the United Kingdom	15	2
To the Continent, Australia, New Zealand, South Africa & Canada	17	4
To the United States of America	$4.25. or 17	4
To the East Indies, China, &c. (*vid* Brindisi)	19	6

All subscriptions are payable in advance.

MR. R. A. PROCTOR'S COURSE OF LECTURES.

1. LIFE OF WORLDS.
2. THE SUN.
3. THE MOON.
4. THE PLANETS.
5. COMETS.
6. THE STAR DEPTHS.

See Advt. Pages for full Syllabus.

The following arrangements are complete: the numbers in brackets referring to above list.

WORCESTER, May 16 (4).
OXFORD, May 19, 20 (3, 4).
MALVERN (The Moon), May 17.
CAMBRIDGE, May 21, 22, 23 (1, 2, 3).
LEICESTER, May 26, 27, 28, 29 (1, 2, 3, 4).
RICHMOND (Star and Garter), June 5, 6 (1, 2).
NOTTINGHAM, June 11, 12, 18, 19 (1, 2, 3, 4).

NOTE.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*